Risk is an inevitable component of intermediation and trading activity. Given the fundamental trade-off between risks and returns, the objective of regulators is to determine when risk exposures either become excessive relative to the financial institution's capital position and financial condition or have not been identified to the extent that the situation represents an unsafe and unsound banking practice.

Determination of whether the institution's risk-management system can measure and control its risks is of particular importance. The primary components of a sound risk-management process are a comprehensive risk-measurement approach; a detailed structure of limits, guidelines, and other parameters used to govern risk taking; and a strong management information system for monitoring and reporting risks. These components are fundamental to both trading and nontrading activities. Moreover, the underlying risks associated with these activities, such as market, credit, liquidity, operations, and legal risks, are not new to banking, although their measurement can be more complex for trading activities than for lending activities. Accordingly, the process of risk management for capital-markets and trading activities should be integrated into the institution's overall risk-management system to the fullest extent possible using a conceptual framework common to the financial institution's other business activities. Such a common framework enables the institution to consolidate risk exposure more effectively, especially since the various individual risks involved in capital-markets and trading activities can be interconnected and may transcend specific markets.

The examiner must apply a multitude of analyses to appropriately assess the risk-management system of an institution. The assessment of risk-management systems and controls may be performed in consideration of the type of risk, the type of instrument, or by function or activity. The examiner must become familiar with the institution's range of business activities, global risk-management framework, risk-measurement models, and system of internal controls. Furthermore, the examiner must assess the qualitative and quantitative assumptions implicit in the risk-management system as well as the effectiveness of the institution's approach to controlling risks. The examiner must determine that the computer system, management information reports, and other forms of communication are adequate and accurate for the level of business activity of the institution.

GLOBAL RISK-MANAGEMENT FRAMEWORK

The primary goal of risk management is to ensure that a financial institution's trading, position-taking, credit extension, and operational activities do not expose it to losses that could threaten the viability of the firm. Global risk management is ultimately the responsibility of senior management and the board of directors; it involves setting the strategic direction of the firm and determining the firm's tolerance for risk. The examiner should verify that the risk management of capital-markets and trading activities is embedded in a strong global (firmwide) risk-management system, and that senior management and the directors are actively involved in overseeing the risk management of capital-markets products.

Role of Senior Management and the Board of Directors

Senior management and the board of directors have a responsibility to fully understand the risks involved in the institution's activities, question line management about the nature and management of those risks, set high standards for prompt and open discussion of internal control problems and losses, and engage management in discussions regarding the events or developments that could expose the firm to substantial loss. The commitment to risk management in any organization should be clearly delineated in practice and codified in written policies and procedures approved by the board of directors. These policies should be consistent with the financial institution's broader business strategies and overall willingness to take risk. Accordingly, the board of directors should be informed regularly of the risk exposure of the institution and should regularly reevaluate the organization's exposure and its risk tolerance regarding these activities. Middle and senior

management, including trading and control staff, should be well versed in the risk-measurement and risk-management methodology of the financial institution.

Senior management is responsible for ensuring that adequate policies and procedures for conducting long-term and day-to-day activities are in place. This responsibility includes ensuring clear delineations of responsibility for managing risk, adequate systems for measuring risk, appropriately structured limits on risk taking, effective internal controls, and a comprehensive risk-reporting process.

The risk-management mandate from senior management and the board of directors should include—

- identifying and assessing risks
- establishing policies, procedures, and risk limits
- monitoring and reporting compliance with limits
- delineating capital allocation and portfolio management
- developing guidelines for new products and including new exposures within the current framework
- applying new measurement methods to existing products

The limit structure should reflect the risk-measurement system in place, as well as the financial institution's tolerance for risk, given its risk profile, activities, and management's objectives. The limit structure should also be consistent with management's experience and the overall financial strength of the institution.

In addition, senior management and the board of directors are responsible for maintaining the institution's activities with adequate financial support and staffing to manage and control the risks of its activities. Highly qualified personnel must staff not only front-office positions such as trading desks, relationship or account officers, and sales, but also all back-office functions responsible for risk management and internal control.

Comprehensiveness of the Risk-Management System

The examiner should verify that the global risk-management system is comprehensive and adequately identifies the major risks to which the institution is exposed. The global risk-management system should cover all areas of the institution, including "special portfolios" such as exotic currency and interest-rate options or specially structured derivatives. At a minimum, the global risk-management system should provide for the separate institution-wide measurement and management of credit, market, liquidity, legal, and operational risk.

The evaluation of the firm's institution-wide risk relative to the firm's capital, earnings capacity, market liquidity, and professional and technological resources is an essential responsibility of senior management. The examiner should also verify that senior management oversees each of the major risk categories (credit, market, liquidity, operational, and legal risk).

Examiners should ascertain whether the financial institution has an effective process to evaluate and review the risks involved in products that are (1) either new to the firm or new to the marketplace and (2) of potential interest to the firm. In general, a bank should not trade a product until senior management and all relevant personnel (including those in risk management, internal control, legal, accounting, and audit) understand the product and are able to integrate the product into the financial institution's risk-measurement and control systems. Examiners should determine whether the financial institution has a formal process for reviewing new products and whether it introduces new products in a manner that adequately limits potential losses.

Financial institutions active in the derivatives markets generate many new products that are variants of existing instruments they offer. In evaluating whether these products should be subject to the new-product-evaluation process, examiners should consider whether the firm has adequately identified and aggregated all significant risks. In general, all significant structural variations in options products should receive some form of new-product review, even when the firm is dealing in similar products.

ORGANIZATIONAL STRUCTURE OF RISK MANAGEMENT

Examiners should evaluate the company's organizational structure and job descriptions to make sure that there is a clear understanding of the

appropriate personnel interaction required to control risk. In particular, measuring and setting parameters for the total amount of various risks facing the institution are distinct functions that should be clearly separated from the day-to-day management of risks associated with the normal flow of business. Normally, these parameters should be managed independently by senior management, with approval from the institution's board of directors.

The trading-risk-management role within an organization includes defining trading-risk-management policies, setting uniform standards of risk assessment and capital allocation, providing senior management with global risk reporting and evaluation, monitoring compliance with limits, and assisting in strategic planning related to risk management.

In some organizations, risk management has a control or policing function; in others, it is a counselor to the trading-operations area. Regardless of how it is implemented, the risk-management function should have reporting lines that are fully independent of the trading groups.

When defining an institution's exposures, risk managers must address all risks, those that are easily quantifiable and those that are not. Many trading risks lend themselves to common financial-estimation methods. Quantifiable risks related to price changes should be applied consistently to derive realistic estimates of market exposure. Consequently, examiners must subjectively and pragmatically evaluate an institution's risk related to capital-markets and trading activities.

The risk measurement and management of an institution will only be as strong as its internal control system. Effective internal control mechanisms for monitoring risk require that risk managers maintain a level of independence from the trading and marketing functions—a requirement not only for the development of the conceptual framework applied but for determining the applicable parameters used in daily evaluations of market risks. This function would be responsible for measuring risk, setting risk parameters, identifying risk vulnerabilities, monitoring risk limits, and evaluating or validating pricing and valuation models. Examiners should ascertain that the financial institution has some form of independent risk management and that management information is comprehensive and reported to senior management on a frequency commensurate with the level of trading activity.

The day-to-day management of risks that occur in the normal course of business can be accomplished through either centralized or decentralized structures. The choice of approach should reflect the organization's risk profile, trading philosophy, and strategy. In a highly decentralized structure, examiners should ascertain that adequate controls are in place to ensure the integrity of the aggregate information provided to senior management and the board of directors.

Trading positions must be accurately transmitted to the risk-measurement systems. The appropriate reconciliations should be performed to ensure data integrity across the full range of products, including new products that may be monitored apart from the main processing networks. Management reports should be reviewed to determine the frequency and magnitude of limit excesses over time. Traders, risk managers, and senior management should be able to define constraints on trading and justify identified excesses. The integrity of the management information system is especially important in this regard (See section 2040.1, ''Operations and Systems Risk (Management Information Systems)''.) Examiners should also review and assess the compensation arrangements of risk-management staff to ensure that there are no incentives which may conflict with maintaining the integrity of the risk-control system.

Measurement of Risks

The increasing globalization and complexity of capital markets and the expanding range of esoteric financial instruments have made trading-risk management more difficult to accomplish and evaluate. Fortunately, a number of commonly used risk-measurement systems have been developed to assist financial institutions in evaluating their unique combinations of risk exposures. These systems all aim to identify the risks associated with particular business activities and group them into generic components, resulting in a single measure for each type of risk. These systems also allow institutions to manage risks on a portfolio basis and to consider exposures in relation to the institution's global strategy and risk profile.

Managing the residual exposure or net position of a portfolio, instead of separate transactions and positions, provides two important benefits: a better understanding of the port-

folio's exposure and more efficient hedging. A market maker's portfolio benefits from economies of scale in market-risk management because large portfolios tend to contain naturally offsetting positions, which may significantly reduce the overall market risk. Hedging the residual risk of the net portfolio position rather than individual transactions greatly reduces transactions costs. A portfolio-focused management approach reduces the complexity of position tracking and management.

All major risks should be measured explicitly and consistently and integrated into the firmwide risk-management system. Systems and procedures should recognize that measurement of some types of risk is an approximation and that some risks, such as the market liquidity of a marketable instrument, can be very difficult to quantify and can vary with economic and market conditions. Nevertheless, at a minimum, the vulnerabilities of the firm to these risks should be explicitly assessed on an ongoing basis in response to changing circumstances.

Sound risk-measurement practices include the careful and continuous identification of possible events or changes in market behavior that could have a detrimental impact on the financial institution. The financial institution's ability to withstand economic and market shocks points to the desirability of developing comprehensive and flexible data-management systems.

Risk Limits

The risk-management system should include a sound system of integrated institution-wide risk limits that should be developed under the direction of and approved by senior management and the board of directors. The established limits structure should apply to all risks arising from an institution's activities. For credit and market risk, in particular, limits on derivatives should be directly integrated with institution-wide limits on those risks as they arise in all other activities of the firm. When risks are not quantifiable, management should demonstrate an awareness of their potential impact.

In addition to credit risk and market risk, limits or firm guidelines should be established to address liquidity and funding risk, operational risk, and legal risk. Careful assessment of operational risk by the financial institution is especially important, since the identification of vulnerabilities in the operational process can often lead to improvements in procedures, data processing systems, and contingency plans that significantly reduce operational risk.

Examiners should ascertain whether management has considered the largest losses which might arise during adverse events, even scenarios which the financial institution may consider fairly remote possibilities. The evaluation of worst-case scenarios does not suggest that the limits themselves must reflect the outcomes of a worst-case scenario or that the financial institution would be imprudent to assume risk positions that involve large losses if remote events were to occur. However, financial institutions should have a sense of how large this type of risk might be and how the institution would manage its positions if such an event occured. Evaluation of such scenarios is crucial to risk management since significant deviations from past experience do occur, such as the breakdown in 1992 and 1993 of the traditionally high correlation of the movements of the dollar and other European currencies of the European monetary system.

An institution's exposures should be monitored against limits by control staff who are fully independent of the trading function. The process for approving limit excesses should require that, before exceeding limits, trading personnel obtain at least oral approval from senior management independent of the trading area. The organization should require written approval of limit excesses and maintenance of such documentation. Limits need not be absolute; however, appropriate dialogue with nontrading senior management should take place before limits are exceeded. Finally, senior management should properly address repeated limit excesses and divergences from approved trading strategies.

Procedures should address the frequency of limit review, method of approval, and authority required to change limits. Relevant management reports and their routing through the organization should be delineated.

Maintenance Issues

Complex instruments require sound analytical tools to assess their risk. These tools are grounded in rigorous financial theory and mathematics. As an institution commits more resources to structured products, complex cash instruments, or derivatives, existing staff will be required to develop an understanding of the

methodologies applied. Institutions should not create an environment in which only trading staff can evaluate market risk; information on new products and their attendant risks should be widely disseminated.

Concurrent with the review of the existing risk-management framework, the resources provided to maintain the integrity of the risk-measurement system should be evaluated. Limits should be reviewed at least annually. Assumptions underlying the established limits should be reviewed in the context of changes in strategy, the risk tolerance of the institution, or market conditions. Automated systems should be upgraded to accommodate increased volumes and added financial complexity, either in applying new valuation methodologies or implementing tools to evaluate new products. Products that are recorded ''off-line,'' that is, not on the mainframe or LAN (linked personal computers), should provide automated data feeds to the risk-measurement systems to reduce the incidence of manual error.

Internal Controls and Audits

A review of internal controls has long been central to the examination of capital-markets and trading activities. The examiner should review the system of internal controls to ensure that they promote effective and efficient operations; reliable financial and regulatory reporting; and compliance with relevant laws and regulations, safe and sound banking practices, and policies of the board of directors and management. Evaluating the ability of internal controls to achieve these objectives involves understanding and documenting adherence to control activities such as approvals, verifications, and reconciliations.

When evaluating internal controls, examiners should consider the frequency, scope, and findings of internal and external audits and the ability of those auditors to review the capital-markets and trading activities. Internal auditors should audit and test the risk-management process and internal controls periodically, with the frequency based on a careful risk assessment. Adequate test work should be conducted to re-create summary risk factors in management reports from exposures in the trading position. This may include validation of risk-measurement algorithms independent of the trading or control functions with special emphasis on new, complex products. Internal auditors should also test compliance with risk limits and evaluate the reliability and timeliness of information reported to the financial institution's senior management and the board of directors. Internal auditors are also expected to evaluate the independence and overall effectiveness of the financial institution's risk-management functions.

The level of confidence that examiners place in the audit work, the nature of the audit findings, and management's response to those findings will influence the scope of the current examination. Even when the audit process and findings are satisfactory, examiners should test critical internal controls, including the revaluation process, the credit-approval process, and adherence to established limits. Significant changes in product lines; modeling; or risk-management methodologies, limits, and internal controls should receive special attention. Substantial changes in earnings from capital-markets and trading activities, in the size of positions, or the value-at-risk associated with these activities should also be investigated during the examination. These findings and evaluations and other factors, as appropriate, should be the basis for decisions to dedicate greater resources to examining the trading functions.

SOUND PRACTICES

Capital-markets and trading operations vary significantly among financial institutions, depending on the size of the trading operation, trading and management expertise, organizational structures, the sophistication of computer systems, the institution's focus and strategy, historical and expected income, past problems and losses, risks, and types and sophistication of the trading products and activities. As a result, the risk-management practices, policies, and procedures expected in one institution may not be necessary in another. With these caveats in mind, a list of sound practices for financial institutions actively engaged in capital-markets and trading operations follows:

- Every organization should have a risk-management function that is independent of its trading staff.
- Every organization should have a risk-management policy that is approved by the board of directors annually. The policy should outline products traded, parameters for risk

activities, the limit structure, over-limit-approval procedures, and frequency of review. In addition, every organization should have a process to periodically review limit policies, pricing assumptions, and model inputs under changing market conditions. In some markets, frequent, high-level review of such factors may be warranted.

- Every organization should have a new-product policy that requires review and approval by all operational areas affected by such transactions (for example, risk management, credit management, trading, accounting, regulatory reporting, back office, audit, compliance, and legal). This policy should be evidenced by an audit trail of approvals before a new product is introduced.
- Every organization should be able to aggregate each major type of risk on a single common basis, including market, credit, and operational risks. Ideally, risks would be evaluated within a value-at-risk framework to determine the overall level of risk to the institution. The risk-measurement system should also permit disaggregation of risk by type and by customer, instrument, or business unit to effectively support the management and control of risks.
- Every organization should have a methodology to stress test the institution's portfolios with respect to key variables or events to create plausible worst-case scenarios for review by senior management. The limit structure of the institution should consider the results of the stress tests.
- Every organization should have an integrated management information system that controls market risks and provides comprehensive reporting. The sophistication of the system should match the level of risk and complexity of trading activity. Every institution should have adequate financial applications in place to quantify and monitor risk positions and to process the variety of instruments currently in use. A minimum of manual intervention should be required to process and monitor transactions.
- Risk management or the control function should be able to produce a risk-management report that highlights positions, limits, and excesses on a basis commensurate with trading activity. This report should be sent to senior management, reviewed, signed, and returned to control staff.
- Counterparty credit exposure on derivative transactions should be measured on a replacement-cost and potential-exposure basis. Every organization should perform a periodic assessment of credit exposure to redefine statistical parameters used to derive potential exposure.
- With regard to credit risk, any organization that employs netting should have a policy related to netting agreements. Appropriate legal inquiry should be conducted to determine enforceability by jurisdiction and counterparty type. Netting should be implemented only when legally enforceable.
- Every organization should have middle and senior management inside and outside the trading room who are familiar with the stated philosophy on market and credit risk. Also, pricing methods employed by the traders should be well understood.
- Every organization should be cognizant of nonquantifiable risks (such as operational risks), have an approach to assessing them, and have guidelines and trading practices to control them.
- Every organization with a high level of trading activity should be able to demonstrate that it can adjust strategies and positions under rapidly changing market conditions and crisis situations on a timely basis.
- For business lines with high levels of activity, risk management should be able to review exposures on an intraday basis.
- Management information systems should provide sufficient reporting for decision making on market and credit risks, as well as operational data including profitability, unsettled items, and payments.
- A periodic compliance review should be conducted to ensure conformity with federal, state, and foreign securities laws and regulatory guidelines.
- Every institution should have a compensation system that does not create incentives which may conflict with maintaining the integrity of the risk-control system.
- Auditors should perform a comprehensive review of risk management annually, emphasizing segregation of duties and validation of data integrity. Additional test work should be performed when numerous new products or models are introduced. Models used by both the front and back offices should be reassessed periodically to ensure sound results.

Market risk is the potential that changes in the market prices of an institution's holdings may have an adverse effect on its financial condition. The four most common market-risk factors are interest rates, foreign-exchange rates, equity prices, and commodity prices. The market risk of both individual financial instruments and portfolios of instruments can be a function of one, several, or all of these basic factors and, in many cases, can be significantly complex. The market risks arising from positions with options, either explicit or embedded in other instruments, can be especially complex and difficult to manage. Institutions should ensure that they adequately measure, monitor, and control the market risks involved in their trading activities.

The measurement of market risk should take due account of hedging and diversification effects and should recognize generally accepted measurement techniques and concepts. Although several types of approaches are available for measuring market risk, institutions have increasingly adopted the ''value-at-risk'' approach for their trading operations. Regardless of the specific approach used, risk measures should be sufficiently accurate and rigorous to adequately reflect all of an institution's meaningful market-risk exposure and should be adequately incorporated into the risk-management process.

Risk monitoring is the foundation of an effective risk-management process. Accordingly, institutions should ensure that they have adequate internal reporting systems that address their market-risk exposures. Regular reports with appropriate detail and frequency should be provided to the various levels of trading operations and senior management, from individual traders and trading desks to business-line management and senior management and, ultimately, the board of directors.

A well-constructed system of limits and policies on acceptable levels of risk exposure is a particularly important element of risk control in trading operations. Financial institutions should establish limits for market risk that relate to their risk measures and are consistent with maximum exposures authorized by their senior management and board of directors. These limits can be allocated to business units, product lines, or other appropriate organizational units and should be clearly understood by all relevant parties. In practice, some limit systems often include additional elements such as stop-loss limits and other trading guidelines that may play an important role in controlling risk at the trader and business-unit level. All limits should be appropriately enforced and adequate internal controls should exist to ensure that any exceptions to limits are detected and adequately addressed by management.

TYPES OF MARKET RISKS

Interest-Rate Risk

Interest-rate risk is the potential that changes in interest rates may adversely affect the value of a financial instrument or portfolio, or the condition of the institution as a whole. Although interest-rate risk arises in all types of financial instruments, it is most pronouced in debt instruments, derivatives that have debt instruments as their underlying reference asset, and other derivatives whose values are linked to market interest rates. In general, the values of longer-term instruments are often more sensitive to interest-rate changes than the values of shorter-term instruments.

Risk in trading activities arises from open or unhedged positions and from imperfect correlations between offsetting positions. With regard to interest-rate risk, open positions arise most often from differences in the maturities or repricing dates of positions and cash flows that are asset-like (i.e., ''longs'') and those that are liability-like (i.e., ''shorts''). The exposure that such ''mismatches'' represent to an institution depends not only on each instrument's or position's sensitivity to interest-rate changes and the amount held, but also on how these sensitivities are correlated within portfolios and, more broadly, across trading desks and business lines. In sum, the overall level of interest-rate risk in an open portfolio is determined by the extent to which the risk characteristics of the instruments in that portfolio interact.

Imperfect correlations in the behavior of offsetting or hedged instruments in response to changes in interest rates—both across the yield curve and within the same maturity or repricing category—can allow for significant interest-rate risk exposure. Offsetting positions with different maturities, although theoretically weighted to

create hedged positions, may be exposed to imperfect correlations in the underlying reference rates. Such ''yield curve'' risk can arise in portfolios in which long and short positions of different maturities are well hedged against a change in the overall level of interest rates, but not against a change in the shape of the yield curve when interest rates of different maturities change by varying amounts.

Imperfect correlation in rates and values of offsetting positions within a maturity or repricing category can also be a source of significant risk. This ''basis'' risk exists when offseting positions have different and less than perfectly correlated coupon or reference rates. For example, three-month interbank deposits, three-month Eurodollars, and three-month Treasury bills all pay three-month interest rates. However, these three-month rates are not perfectly correlated with each other, and spreads between their yields may vary over time. As a result, three-month Treasury bills, for example, funded by three-month Eurodollar deposits, represent an imperfectly offset or hedged position. One variant of basis risk that is central to the management of global trading risk is ''cross-currency interest-rate risk,'' that is, the risk that comparable interest rates in different currency markets may not move in tandem.

Foreign-Exchange Risk

Foreign-exchange risk is the potential that movements in exchange rates may adversely affect the value of an institution's holdings and, thus, its financial condition. Foreign-exchange rates can be subject to large and sudden swings, and understanding and managing the risk associated with exchange-rate volatility can be especially complex. Although it is important to acknowledge exchange rates as a distinct market-risk factor, the valuation of foreign-exchange instruments generally requires knowledge of the behavior of both spot exchange rates and interest rates. Any forward premium or discount in the value of a foreign currency relative to the domestic currency is determined largely by relative interest rates in the two national markets.

As with all market risks, foreign-exchange risk arises from both open or imperfectly offset or hedged positions. Imperfect correlations across currencies and international interest-rate markets pose particular challenges to the effectiveness of foreign-currency hedging strategies.

Equity-Price Risk

Equity-price risk is the potential for adverse changes in the value of an institution's equity-related holdings. Price risks associated with equities are often classified into two categories: general (or undiversifiable) equity risk and specific (or diversifiable) equity risk.

''General equity-price risk'' refers to the sensitivity of an instrument's or portfolio's value to changes in the overall level of equity prices. As such, general risk cannot be reduced by diversifying one's holdings of equity intruments. Many broad equity indexes, for example, primarily involve general market risk.

Specific equity-price risk refers to that portion of an individual equity instrument's price volatility that is determined by the firm-specific characteristics. This risk is distinct from market-wide price fluctuations and can be reduced by diversification across other equity instruments. By assembling a portfolio with a sufficiently large number of different securities, specific risk can be greatly reduced because the unique fluctuations in the price of any single equity will tend to be canceled out by fluctuations in the opposite direction of prices of other securities, leaving only general-equity risk.

Commodity-Price Risk

Commodity-price risk is the potential for adverse changes in the value of an institution's commodity-related holdings. Price risks associated with commodities differ considerably from interest-rate and foreign-exchange-rate risk and require even more careful monitoring and management. Most commodities are traded in markets in which the concentration of supply can magnify price volatility. Moreover, fluctuations in market liquidity often accompany high price volatility. Therefore, commodity prices generally have higher volatilities and larger price discontinuities than most commonly traded financial assets. An evaluation of commodity-price risk should be performed on a market-by-market basis and include not only an analysis of historical price behavior, but also an assessment of the structure of supply and demand in the

marketplace to evaluate the potential for unusually large price movements.

OPTIONS

Exposure to any and all of the various types of market risk can be significantly magnified by the presence of explicit or embedded options in instruments and portfolios. Moreover, assessing the true risk profile of options can be complex. Under certain conditions, the significant leverage involved in many options can translate small changes in the underlying reference instrument into large changes in the value of the option.

Moreover, an option's value is, in part, highly dependent on the likelihood or probability that it may become profitable to exercise in the future. In turn, this probability can be affected by several factors including the time to expiration of the option and the volatility of the underlying reference instrument. Accordingly, factors other than changes in the underlying reference instrument can lead to changes in the value of the option. For example, as the price variability of the reference instrument increases, the probability that the option becomes profitable increases. Therefore, a change in the market's assessment of volatility can affect the value of an option even without any change in the current price of the underlying asset.

The presence of option characteristics is a major complicating factor in managing the market risks of trading activities. Institutions should ensure that they fully understand, measure, and control the various sources of optionality influencing their market-risk exposures. Measurement issues arising from the presence of options are addressed more fully in the instrument profile on options (section 4330.1).

MARKET-RISK MEASUREMENT

There are a number of methods for measuring the various market risks encountered in trading operations. All require adequate information on current positions, market conditions, and instrument characteristics. Regardless of the methods used, the scope and sophistication of an institution's measurement systems should be commensurate with the scale, complexity, and nature of its trading activities and positions held.

Adequate controls should be imposed on all elements of the process for market-risk measurement and monitoring, including the gathering and transmission of data on positions, market factors and market conditions, key assumptions and parameters, the calculation of the risk measures, and the reporting of risk exposures through appropriate chains of authority and responsibility. Moreover, all of these elements should be subject to internal validation and independent review.

In most institutions, computer models are used to measure market risk. Even within a single organization, a large number of models may be used, often serving different purposes. For example, individual traders or desks may use ''quick and dirty'' models that allow speedy evaluation of opportunities and risks, while more sophisticated and precise models are needed for daily portfolio revaluation and for systematically evaluating the overall risk of the institution and its performance against risk limits. Models used in the risk-measurement and front- and back-office control functions should be independently validated by risk-management staff or by internal or outside auditors.

Examiners should ensure that institutions have internal controls to check the adequacy of the valuation parameters, algorithms, and assumptions used in market-risk models. Specific considerations with regard to the oversight of models used in trading operations and the adequacy of reporting systems are discussed in sections 2100 and 2110, ''Financial Performance'' and ''Capital Adequacy of Trading Activities,'' respectively.

Basic Measures of Market Risk

Nominal Measures

Nominal or notional measurements are the most basic methodologies used in market-risk management. They represent risk positions based on the nominal amount of transactions and holdings. Typical nominal measurement methods may summarize net risk positions or gross risk positions. Nominal measurements may also be used in conjunction with other risk-measurement methodologies. For example, an institution may use nominal measurements to control market risks arising from foreign-exchange trading while using duration measurements to control interest-rate risks.

For certain institutions with limited, noncomplex risk profiles, nominal measures and controls based on them may be sufficient to adequately control risk. In addition, the ease of computation in a nominal measurement system may provide more timely results. However, nominal measures have several limitations. Often, the nominal size of an exposure is an inaccurate measure of risk since it does not reflect price sensitivity or price volatility. This is especially the case with derivative instruments. Also, for sophisticated institutions, nominal measures often do not allow an accurate aggregation of risks across instruments and trading desks.

Factor-Sensitivity Measures

Basic factor-sensitivity measures offer a somewhat higher level of measurement sophistication than nominal measures. As the name implies, these measures gauge the sensitivity of the value of an instrument or portfolio to changes in a primary risk factor. For example, the price value of a basis point change in yield and the concept of duration are often used as factor-sensitivity measures in assessing the interest-rate risk of fixed-income instruments and portfolios. Beta, or the measure of the systematic risk of equities, is often considered a first-order sensitivity measure of the change in an equity-related instrument or portfolio to changes in broad equity indexes.

Duration provides a useful illustration of a factor-sensitivity measure. Duration measures the sensitivity of the present value or price of a financial instrument with respect to a change in interest rates. By calculating the weighted average duration of the instruments held in a portfolio, the price sensitivity of different instruments can be aggregated using a single basis that converts nominal positions into an overall price sensitivity for that portfolio. These portfolio durations can then be used as the primary measure of interest-rate risk exposure.

Alternatively, institutions can express the basic price sensitivities of their holdings in terms of one representative instrument. Continuing the example using duration, an institution may convert its positions into the duration equivalents of one reference instrument such as a four-year U.S. Treasury, three-month Eurodollar, or some other common financial instrument. For example, all interest-rate risk exposures might be converted into a dollar amount of a ''two-year'' U.S. Treasury security. The institution can then aggregate the instruments and evaluate the risk as if the instruments were a single position in the common base.

While basic factor-sensitivity measures can provide useful insights, they do have certain limitations—especially in measuring the exposure of complex instruments and portfolios. For example, they do not assess an instrument's convexity or volatility and can be difficult to understand outside of the context of market events. Examiners should ensure that factor-sensitivity measures are used appropriately and, where necessary, supported with more sophisticated measures of market-risk exposure.

Basic Measures of Optionality

At its most basic level, the value of an option can generally be viewed as a function of the price of the underlying instrument or reference rate relative to the exercise price of the option, the volatility of the underlying instrument or reference rate, the option contract's time to expiration, and the level of market interest rates. Institutions may use simple measures of each of these elements to identify and manage the market risks of their option positions, including the following:

- ''Delta'' measures the degree to which the option's value will be affected by a (small) change in the price of the underlying instrument.
- ''Gamma'' measures the degree to which the option's delta will change as the instrument's price changes; a higher gamma typically implies that the option has greater value to its holder.
- ''Vega'' measures the sensitivity of the option value to changes in the market's expectations for the volatility of the underlying instrument; a higher vega typically increases the value of the option to its holder.
- ''Theta'' measures how much an option's value changes as the option moves closer to its expiration date; a higher theta is typically associated with a higher option value to its holder.
- ''Rho'' measures how an option's value changes in response to a change in short-term interest rates; a higher rho typically is associated with a lower option value to its holder.

Measurement issues arising from the presence of options are addressed more fully in the instrument profile on options (section 4330.1).

Scenario Simulations

Another level of risk-exposure measurement is the direct estimation of the potential change in the value of instruments and portfolios under specified scenarios of changes in risk factors. On a simple basis, changes in risk factors can be applied to factor-sensitivity measures such as duration or the present value of a basis point to derive a change in value under the selected scenario. These scenarios can be arbitrarily determined or statistically inferred either from analyzing historical data on changes in the appropriate risk factor or from running multiple forecasts using a modeled or assumed stochastic process that describes how a risk factor may behave under certain circumstances. In statistical inference, a scenario is selected based on the probability that it will occur over a selected time horizon. A simple statistical measure used to infer such probabilities is the standard deviation.

Standard deviation is a summary measure of the dispersion or variability of a random variable such as the change in price of a financial instrument. The size of the standard deviation, combined with some knowledge of the type of probability distribution governing the behavior of a random variable, allows an analyst to quantify risk by inferring the probability that a certain scenario may occur. For a random variable with a normal distribution, 68 percent of the observed outcomes will fall within plus or minus one (±1) standard deviation of the average change, 90 percent within 1.65 standard deviations, 95 percent within 1.96 standard deviations, and 99 percent within 2.58 standard deviations. Assuming that changes in risk factors are normally distributed, calculated standard deviations of these changes can be used to specify a scenario that has a statistically inferred probability of occurrence (for example, a scenario that would be as severe as 95 percent or 99 percent of all possible outcomes). An alternative to such statistical inference is to use directly observed historical scenarios and assume that their future probability of occurrence is the same as their historical frequency of occurrence.

However, some technicians contend that short-term movements in the prices of many financial instruments are not normally distributed, in particular, that the probability of extreme movements is considerably higher than would be predicted by an application of the normal distribution. Accordingly, more sophisticated institutions use more complex volatility-measurement techniques to define appropriate scenarios.

A particularly important consideration in conducting scenario simulations is the interactions and relationships between positions. These interrelationships are often identified explicitly with the use of correlation coefficients. A correlation coefficient is a quantitative measure of the extent to which changes in one variable are related to another. The magnitude of the coefficient measues the likelihood that the two variables will move together in a linear relationship. Two variables (that is, instrument prices) whose movements correspond closely would have a correlation coefficient close to 1. In the case of inversely related variables, the correlation coefficient would be close to −1.

Conceptually, using correlation coefficients allows an institution to incorporate multiple risk factors into a single risk analysis. This is important for instruments whose value is linked to more than one risk factor, such as foreign-exchange derivatives, and for measuring the risk of a trading portfolio. The use of correlations allows the institution to hedge positions—to partially offset long positions in a particular currency/maturity bucket with short positions in a different currency/maturity bucket—and to diversify price risk for the portfolio as a whole in a unitary conceptual framework. The degree to which individual instruments and positions are correlated determines the degree of risk offset or diversification. By fully incorporating correlation, an institution may be able to express all positions, across all risk factors, as a single risk figure.

Value-at-Risk

Value-at-risk (VAR) is the most common measurement technique used by trading institutions to summarize their market-risk exposures. VAR is defined as the estimated maximum loss on an instrument or portfolio that can be expected over a given time interval at a specified level of probability. Two basic approaches are generally used to forecast changes in risk factors for a

desired probability or confidence interval. One involves direct specification of how market factors will act using a defined stochastic process and Monte Carlo techniques to simulate multiple possible outcomes. Statistical inference from these multiple outcomes provides expected values at some confidence interval. An alternative approach involves the use of historical changes in risk factors and parameters observed over some defined sample period. Under this alternative approach, forecasts can be derived using either variance-covariance or historical-simulation methodologies. Variance-covariance estimation uses standard deviations and correlations of risk factors to statistically infer the probability of possible scenarios, while the historical-simulation method uses actual distributions of historical changes in risk factors to estimate VAR at the desired confidence interval.

Some organizations allocate capital to various divisions based on an internal transfer-pricing process using measures of value-at-risk. Rates of return from each business unit are measured against this capital to assess the unit's efficiency as well as to determine future strategies and commitments to various business lines. In addition, as explained in the section on capital adequacy, the internal value-at-risk models are used for risk-based capital purposes.

Assumptions about market liquidity are likely to have a critical effect on the severity of conditions used to estimate risk. Some institutions may estimate exposure under the assumption that dynamic hedging or other rapid portfolio adjustments will keep risk within a given range even when significant changes in market prices occur. Dynamic hedging depends on the existence of sufficient market liquidity to execute the desired transactions at reasonable costs as underlying prices change. If a market-liquidity disruption were to occur, the difficulty of executing transactions would cause the actual market risk to be higher than anticipated.

To recognize the importance of market-liquidity assumptions, measures such as value-at-risk should be estimated over a number of different time horizons. The use of a short time horizon, such as a day, may be useful for day-to-day risk management. However, prudent managers will also estimate risk over longer horizons, since the use of a short horizon relies on an assumption that market liquidity will always be sufficient to allow positions to be closed out at minimal losses. In a crisis, the firm's access to markets may be so impaired that closing out or hedging positions may be impossible except at extremely unfavorable prices, in which case positions may be held for longer than envisioned. This unexpected lengthening of the holding period will cause a portfolio's risk profile to be much greater than expected because the likelihood of a large price change increases with time (holding period), and the risk profile of some instruments, such as options, changes substantially as their remaining time to maturity decreases.

Stress Testing

The underlying statistical methods used in daily risk measurements summarize exposures that reflect the most probable market conditions. Market participants should periodically perform simulations to determine how their portfolios will perform under exceptional conditions. The framework of this stress testing should be detailed in the risk-management policy statement, and senior management should be regularly apprised of the findings. Assumptions should be critically questioned and input parameters altered to reflect changing market conditions.

The examiner should review available simulations to determine the base case, as well as review comparable scenarios to determine whether the resulting ''worst case'' is sufficiently conservative. Similar analyses should be conducted to derive worst-case credit exposures. Nonquantifiable risks, such as operational and legal risks, constraints on market or product liquidity, and the probability of discontinuities in various trading markets, are important considerations in the review process. Concerns include unanticipated political and economic events which may result in market disruptions or distortions. This overall evaluation should include an assessment of the institution's ability to alter hedge strategies or liquidate positions. Additional attention should be committed to evaluating the frequency of stress tests.

MARKET-RISK LIMITS

Market-risk limits are one of the most fundamental controls over the risks inherent in an institution's trading activities. Banks should establish limits for market risk that relate to their

risk measures and are consistent with maximum exposures authorized by their senior management and board of directors. These limits should be allocated to business units and individual traders and be clearly understood by all relevant parties. Internal controls should ensure that exceptions to limits are detected and adequately addressed by management. In practice, some limit systems include additional elements, such as stop-loss limits and trading guidelines, that may play an important role in controlling risk at the trader and business-unit level. Examiners should include these elements in their review of the limit system. Other institutions may have several levels of limits informally allocated by product or by staff. For example, policy guidelines may give head traders substantial discretion in allocating limits among staff. Some institutions that permit traders to take positions in multiple instruments may apply limits broadly across the organization, with sublevels of advisory limits when gross exposures exceed a given percentage, such as 75 percent, of overall levels.

When analyzing an institution's limits, examiners should evaluate the size of limits against the institution's financial strength. The risks resulting from full utilization of an institution's limits should not compromise its safety and soundness. Examiners should also evaluate the percentage of limit use over time. Excessively large limits may circumvent normal reporting lines; an increase in activity or position may not be properly highlighted to senior management. Conversely, overly restrictive limits which are frequently exceeded may undermine the discipline of the limit structure in place. Finally, examiners should evaluate profitability along with position taking. Institutions should be able to explain abnormal daily profits or losses given the size of their positions.

The following is a summary of limits frequently used by financial institutions:

- *Limits on net and gross positions.* Limits may be placed on gross positions, net positions, or both. Limits on gross positions restrict the size of a long or short position in a given instrument. Limits on net positions, on the other hand, attempt to recognize the natural offset of long and short positions. Institutions generally should employ both types of limits in their risk management.
- *Maximum allowable loss ("stop-loss").* Limits may be established to avoid the accumulation of excessive losses in a position. Typically, if these limits are reached, a senior management response is required to hedge or liquidate a position. These limits are usually more restrictive than overall position limits. Typical stop-loss limits are retrospective and cover cumulative losses for a day, week, or month.
- *Value-at-risk limits.* Management may place limits on the extent to which the value of a portfolio is affected by changes in underlying risk factors. Limits can be specified as the maximum loss for a specified scenario (for example, a 100 basis point change in rates) or for scenarios defined at some specified confidence level derived from internal VAR measures (for example, 99 percent of possible occurrences over a one-day time horizon). Generally, measures of sensitivity are based on historical volatilities of risk.
- *Maturity gap limits.* These limits enable an institution to control the risk of adverse changes in rates for the periods designated in the institution's planning time horizon. Limits might range from stated absolute amounts for each time frame to weighted limits that emphasize increasing rate-movement exposure applicable to the relative distance into the future in which the gap appears. In addition, these limits should specify the maximum maturity of the specific instrument or combination of instruments. Typically, institutions employ maturity gap limits to control risks arising from nonparallel shifts in yield curves and forward curves.
- *Limits on options positions.* An institution should place unique limits on options positions to adequately control trading risks. Options limits should include limits which address exposures to small changes in the price of the underlying instrument (delta), rate of change in the price of the underlying instrument (gamma), changes in the volatility of the price of the underlying instrument (vega), changes in the option's time to expiration (theta), and changes in interest rates (rho).
- *Limits for volatile or illiquid markets.* Management may choose to limit trading in especially volatile markets, in which losses could accumulate quickly, or in illiquid markets, in which management may be forced to take a loss to close a position it cannot offset.

1. To evaluate the organizational structure of the market-risk-management function.
2. To evaluate the adequacy of internal market-risk-management policies and procedures for capital-markets and trading activities and to determine that actual operating practices reflect such policies.
3. To identify the market risks of the institution.
4. To determine if the institution's market-risk-measurement system has been correctly implemented and adequately measures the institution's market risks.
5. To determine how the institution measures nonstandard products such as exotic options, structured financings, and certain mortgage-backed securities.
6. To determine if senior management and the board of directors of the financial institution understand the potential market exposures of the capital-markets and trading activities of the institution.
7. To ensure that business-level management has formulated contingency plans for illiquid market conditions.
8. To review management information systems for comprehensive coverage of market risks.
9. To assess the effectiveness of the global risk-management system and determine if it can evaluate market, liquidity, credit, operational, and legal risks and that management at the highest level is aware of the institution's global exposure.
10. To recommend corrective action when policies, procedures, practices, internal controls, or management information systems are found to be deficient.

These procedures list processes and activities that may be reviewed during a full-scope examination. The examiner-in-charge will establish the general scope of examination and work with the examination staff to tailor specific areas for review as circumstances warrant. As part of this process, the examiner reviewing a function or product will analyze and evaluate internal audit comments and previous examination workpapers to assist in designing the scope of examination. In addition, after a general review of a particular area to be examined, the examiner should use these procedures, to the extent they are applicable, for further guidance. Ultimately, it is the seasoned judgment of the examiner and the examiner-in-charge that determines which procedures are warranted in examining any particular activity.

1. Review the market-risk-management organization.
   a. Check that the institution has a market-risk-management function with separate reporting lines from traders and marketers.
   b. Determine if market-risk-control personnel have sufficient credibility in the financial institution to question traders' and marketers' decisions.
   c. Determine if market-risk management is involved in new-product discussions.
2. Identify the institution's capital-markets and trading activities and the related balance-sheet and off-balance-sheet instruments. Obtain copies of all risk-management reports prepared by the institution.
   a Define the use and purpose of the institution's capital-markets products.
   b. Define the institution's range, scope, and size of risk exposures. Determine the products in which the institution makes markets. Determine the hedging instruments used to hedge these products.
   c. Evaluate market-risk-control personnel's demonstrated knowledge of the products traded by the financial institution and their understanding of current and potential exposures.
3. Obtain and evaluate the adequacy of risk-management policies and procedures for capital-markets and trading activities.
   a. Review market-risk policies, procedures, and limits. Determine whether the risk-measurement model and methodology adequately address all identified market risks and are appropriate for the institution's activities.
   b. Review contingency market-risk plans for adequacy.
   c. Check that limits are in place for market exposures before transacting a deal. If the financial institution relies on one-off approvals, check that the approval process is well documented.
   d. Review accounting and revaluation policies and procedures. Determine that revaluation procedures are appropriate.
4. Determine the credit rating and market acceptance of the financial institution as a counterparty in the markets.
5. Obtain all management information analyzing market risk.
   a. Determine the comprehensiveness, accuracy, and integrity of analysis.
   b. Review valuation and simulation methods in place.
   c. Review stress tests, analyzing changes in market conditions.
   d. Determine whether the management information reports accurately reflect risks and that reports are provided to the appropriate level of management.
6. Determine if any recent market disruptions have affected the institution's trading activities. If so, determine the institution's market response.
7. Establish that the financial institution is following its internal policies and procedures. Determine whether the established limits adequately control the range of market risks. Determine whether management is aware of limit excesses and takes appropriate action when necessary.
8. Determine whether the institution has established an effective audit trail that summarizes exposures and management approvals with the appropriate frequency.
9. Determine whether management considered the full range of exposures when establishing capital-at-risk exposures.
   a. Determine if the financial institution established capital-at-risk limits which address both normal and distressed market conditions.

b. Determine if senior management and the board of directors are advised of market-risk exposures in times of market disruption and under normal market conditions.

10. Determine that business managers have developed contingency plans which outline actions to be taken in times of market disruption to minimize losses as well as the potential damage to the institution's market-making reputation.
11. Based on information provided, determine the institution's exposure from dynamic hedging strategies during times of market disruption.
12. Recommend corrective action when policies, procedures, practices, internal controls, and management information systems are found to be deficient.

1. Review the market-risk-management organization.
   a. Does the institution have a market-risk-management function with separate reporting lines from traders and marketers?
   b. Do market-risk-control personnel have sufficient credibility in the financial institution to question traders' and marketers' decisions?
   c. Is market-risk management involved in new-product discussions in the financial institution?
2. Identify the institution's capital-markets and trading activities and the related balance-sheet and off-balance-sheet instruments and obtain copies of all risk-management reports prepared.
   a. Do summaries identify all the institution's capital-markets products?
   b. Define the role that the institution takes for the range of capital-markets products. Determine the hedging instruments used to hedge these products. Is the institution an end-user, dealer, market maker? In what products?
   c. Do market-risk-control personnel demonstrate knowledge of the products traded by the financial institution? Do they understand the current and potential exposures to the institution?
3. Does the institution have comprehensive, written risk-management policies and procedures for capital-markets and trading activities?
   a. Have limits been approved by the board of directors?
   b. Have policies, procedures, and limits been reviewed and reapproved within the last year?
   c. Are market-risk policies, procedures, and limits clearly defined?
   d. Are the limits appropriate for the institution and the level of capital-markets and trading activity?
   e. Do the limits adequately distinguish between trades used to manage the institution's asset-liability mismatch position and discretionary trading activity?
   f. Are there contingency market-risk plans?
   g. Are there appropriate accounting and revaluation policies and procedures?
   h. Do the policies authorize the use of appropriate hedging instruments?
   i. Do the policies address the use of dynamic hedging strategies?
   j. Do the policies establish market-risk limits which consider bid/ask spreads for the full range of products in normal markets?
   k. Do the policies provide an explanation of the board of directors' and senior management's philosophy regarding illiquid markets?
   l. Do the policies establish market-risk limits which consider bid/ask spreads in distressed markets? How do the policies reflect liquidity concerns?
   m. Are limits in place for market exposures before transacting a deal? If the financial institution relies on one-off approvals, is the approval process well documented?
4. If the financial institution has recently experienced a ratings downgrade, ascertain the impact of the credit-rating downgrade. What has been the market response to the financial institution as a counterparty in the markets? Have instances in which the institution provides collateral to its counterparties significantly increased?
5. Obtain all management information analyzing market risk.
   a. Is management information comprehensive and accurate, and is the analysis sound?
   b. Are the simulation assumptions for a normal market scenario reasonable?
   c. Are stress tests analyzing changes in market condition appropriate? Are the market assumptions reasonable?
   d. Do management information reports accurately reflect risks? Are reports provided to the appropriate level of management?
6. If there have been any recent market disruptions affecting the institution's trading activities, what has been the institution's market response?
7. Is the financial institution following its internal policies and procedures? Do the established limits adequately control the range of market risks? Are the limits appropriate for the institution's level of activity? Is management aware of limit excesses?

Does management take appropriate action when necessary?

8. Has the institution established an effective audit trail that summarizes exposures and management approvals with the appropriate frequency? Are risk-management, revaluations, and close-out valuation reserves subject to audit?
9. Has management considered possible market disruptions when establishing capital-at-risk exposures?
   a. Has the financial institution established capital-at-risk limits which address both normal and distressed market conditions? Are these limits aggregated on a global basis?
   b. Are senior management and the board of directors advised of market-risk exposures in illiquid markets?
10. Have business managers developed contingency plans which outline actions to be taken to minimize losses as well as to minimize the potential damage to the institution's market-making reputation when market disruptions occur? Are management's activities in times of market disruptions prudent?
    a. Do opportunities for liquidation or unwinding of transactions exist?
    b. Is the depth (volume, size, number of market makers) of the market such that undue risk is not being taken?
    c. If executed on an exchange, is the open interest in the contract sufficient to ensure that management would be capable of hedging or closing out open positions in one-way directional markets?
    d. Can management execute transactions in large enough size to hedge and/or close out market-risk exposures without resulting in significant price adjustments?
11. Has management determined the institution's exposure to dynamic hedging strategies during times of market disruption?
12. Does the institution have a methodology for addressing difficult-to-value products or positions?

Broadly defined, credit risk is the risk of economic loss from the failure of an obligor to perform according to the terms and conditions of a contract or agreement. Credit risk exists in all activities that depend on the performance of issuers, borrowers, or counterparties, and virtually all capital-markets and trading transactions involve credit exposure. Over-the-counter (OTC) derivative transactions such as foreign exchange, swaps, and options can involve particularly large and dynamic credit exposures. Accordingly, institutions should ensure that they identify, measure, monitor, and control all of the various types of credit risks encountered in their trading of both derivative and nonderivative products.

Credit risk should be managed through a formal and independent process guided by appropriate policies and procedures. Measurement systems should provide appropriate and realistic estimates of the credit-risk exposure and should use generally accepted measurement methodologies and techniques. The development of customer credit limits and the monitoring of exposures against those limits is a critical control function and should form the backbone of an institution's credit-risk-management process. The most common forms of credit risks encountered in trading activities are issuer credit risk and counterparty credit risk. Issuer risk is the risk of default or credit deterioration of an issuer of instruments that are held as long positions in trading portfolios. While the short time horizon of trading activities limits much of the issuer credit risk for relatively high-quality and liquid instruments, other less-liquid instruments such as loans, emerging-market debt, and below-investment-quality debt instruments, may be the source of significant issuer credit risk.

Counterparty risks, the most significant credit risks faced in trading operations, consist of both ''presettlement'' risk and ''settlement'' risk. Presettlement risk is the risk of loss due to a counterparty's failure to perform on a contract or agreement during the life of a transaction. For most cash instruments, the duration of this risk exposure is limited to the hours or days from the time a transaction is agreed upon until settlement. However, in the case of many derivative products, this exposure can often exist for a period of several years. Given this potentially longer-term exposure and the complexity associated with some derivative instruments, banks should ensure that they fully assess the presettlement credit risks involved with such instruments. This section discusses the nature of the credit risks involved in trading activities and reviews basic credit-risk-management issues.

Settlement risk is the risk of loss when an institution meets its obligation under a contract (through either an advance of funds or securities) before the counterparty meets its obligation. Failures to perform at settlement can arise from counterparty default, operational problems, market liquidity constraints, and other factors. Settlement risk exists from the time an outgoing payment instruction cannot be recalled until the incoming payment is received with finality. This risk exists with any traded product and is greatest when delivery is made in different time zones. Issues and examination procedures regarding settlement risk are discussed at length in section 2021.1.

CREDIT-RISK-MANAGEMENT ORGANIZATION

An institution's process and program for managing credit risks should be commensurate with the range and scope of its activities. Institutions with relatively small trading operations in noncomplex instruments may not need the same level of automated systems and policies, or the same level of highly skilled staff, as firms that make markets in a variety of cash and derivative products.

Credit-risk management should begin at the highest levels of the organization, with credit-risk policies approved by the board of directors, the formation of a credit-risk policy committee of senior management, a credit-approval process, and credit-risk management staff who measure and monitor credit exposures throughout the organization. Although the organizational approaches used to manage credit risk may vary, the credit-risk management of trading activities should be integrated into the overall credit-risk management of the institution to the fullest extent practicable. With regard to policies, most complex banking organizations appear to have extensive written policies covering their assessment of counterparty creditworthiness for both the initial due-diligence process (that is,

before conducting business with a customer) and ongoing monitoring. However, examiners should focus particular attention on how such policies are structured and implemented.

Typically, credit-risk management in trading operations consists of (1) developing and approving credit-exposure measurement standards, (2) setting counterparty credit limits, (3) monitoring credit-limit usage and reviewing credits and concentrations of credit risk, and (4) implementing minimum documentation standards. In general, staff responsible for approving exposures should be segregated from those responsible for monitoring risk limits and measuring exposures. Traders and marketers should not be permitted to assume risks without adequate institutional credit-risk controls.

Institutions with very large trading operations often have a credit function in the trading area; staff in this area develop a high level of expertise in trading-product credit analysis and meet the demand for rapid credit approval in a trading environment. To carry out these responsibilities without compromising internal controls, the credit-risk-management function must be independent of these marketing and trading personnel who are directly involved in the execution of the transactions. While the credit staff in the trading area may possess great expertise in trading-product credit analysis, the persons responsible for the institution's global credit function should have a solid understanding of the measurement of credit-risk exposures in trading products and the techniques available to manage those exposures. The examiner's review of credit-risk management in trading activities should evaluate the quality and timeliness of information going to the global credit function and the way that information is integrated into global exposure reports.

Examiners should evaluate whether banking institutions—

- devote sufficient resources and adequate attention to the management of the risks involved in growing, highly profitable, or potentially high-risk activities and product lines;
- have internal audit and independent risk-management functions that adequately focus on growth, profitability, and risk criteria in targeting their reviews;
- achieve an appropriate balance among all elements of credit-risk management, including both qualitative and quantitative assessments of counterparty creditworthiness; measurement and evaluation of both on- and off-balance-sheet exposures, including potential future exposure; adequate stress testing; reliance on collateral and other credit enhancements; and the monitoring of exposures against meaningful limits;
- employ policies that are sufficiently calibrated to the risk profiles of particular types of counterparties and instruments to ensure adequate credit-risk assessment, exposure measurement, limit setting, and use of credit enhancements;
- ensure that actual business practices conform with stated policies and their intent; and
- are moving in a timely fashion to enhance their measurement of counterparty-credit-risk exposures, including refining potential future exposure measures and establishing stress-testing methodologies that better incorporate the interaction of market and credit risks.

To adequately evaluate these conditions, examiners should conduct sufficient and targeted transaction testing. See SR-99-3 (February 1, 1999).

CREDIT-RISK MEASUREMENT

Appropriate measurement of exposures is essential for effective credit-risk management in trading operations. For most cash instruments, presettlement credit exposure is measured as current carrying value. However, in the case of many derivative contracts, especially those traded in OTC markets, presettlement exposure is measured as the current value or replacement cost of the position, plus an estimate of the institution's potential future exposure to changes in the replacement value of that position over the term of the contract. The methods used to measure counterparty credit risk should be commensurate with the volume and level of complexity of the instruments involved. Importantly, measurement systems should use techniques that present a relevant picture of the true nature of the credit exposures involved. Some techniques used to measure presettlement risk can generate very large exposure estimates that, by definition, are unlikely to materialize. Unrealistic measures of credit exposure suggest important flaws in the institution's risk-management process and should receive special examiner attention.

Presettlement Risk

Presettlement credit exposure for cash instruments is measured as the current carrying value, which for trading operations is the market value or fair value of the instrument. Market values can be obtained from direct market quotations and pricing services or, in the case of more complex instruments, may be estimated using generally accepted valuation techniques. For derivative contracts, credit exposure is measured as the current value or replacement cost of the position, plus an estimate of the institution's potential future exposure to changes in that replacement value in response to market price changes. Together, replacement cost and estimated potential future exposure make up the loan-equivalent value of a derivative contract.

For derivative contracts, presettlement exposure to a counterparty exists whenever a contract's replacement cost has positive value to the institution (''in the money'') and negative value to the counterparty (''out of the money''). The current replacement cost of the contract is its mark-to-market value. If a counterparty defaults on a transaction before settlement or expiration of the deal, the other counterparty has an immediate exposure which must be filled. If the contract is in the money for the nondefaulting party, then the nondefaulting counterparty has suffered a credit loss. Thus, all deals with a positive mark-to-market value represent actual credit exposure. The replacement cost of derivative contracts is usually much smaller than the face or notional value of derivative transactions.

Some derivatives involving firm commitments, such as swaps, initially have a zero net present value and, therefore, no replacement cost at inception. At inception, the only potential for credit exposure these contracts have is what can arise from subsequent changes in the market price of the instrument, index, or interest rate underlying them. Once market prices move to create a positive contract value, the contract has the current credit-risk exposure of its replacement cost as well as the potential credit exposure that can arise from subsequent changes in market prices.

Options and derivative contracts which contain options (for example, swaptions and rate-protection agreements) face both current and potential credit exposure. However, a difference with option contracts is that they have a positive value at inception reflected by the premium paid by the purchaser to the writer of the option. The value of the purchased option may be reduced as a result of market movements, but cannot become negative. The seller or writer of an option receives a premium, usually at inception, and must deliver the underlying at exercise. Therefore, the party that buys the option contract will always have credit exposure when the option is in the money, and the party selling the option contract will have none, except for settlement risk while awaiting payment of the premium.

Potential Future Exposure

Potential future exposure is an estimate of the risk that subsequent changes in market prices could increase credit exposure. In measuring potential exposure, institutions attempt to determine how much a contract can move into the money for the institution and out of the money for the counterparty over time. Given the important interrelationships between the market-risk and credit-risk exposures involved in banks' derivative activities that have been emphasized over the past two years of financial-market turbulence, examiners should be alert to situations in which banks may need to enhance their current computations of potential future exposures and loan equivalents used to measure and monitor their derivative counterparty credit exposure.

Estimating potential exposure can be subjective, and firms approach its measurement in several different ways. One technique is to use ''rules of thumb'' or factors, such as percentages of the notional value of the contract, similar to the ''add-on'' factors used in bank risk-based capital. Institutions using such an approach should be able to demonstrate that the rules of thumb or factors provide adequate estimates of potential exposure. For example, differences in the add-ons used for different instruments should reflect differences in the volatility of the underlying instruments and in the tenor (or maturity) across instruments, and should be adjusted periodically to reflect changes in market conditions and the passage of time.

A more sophisticated and complex practice of measuring the potential exposure of derivatives is to statistically estimate the maximum probable value that the derivative contract might reach over a specified time horizon, which sometimes may be the life of the contract. This is often done by estimating the highest value the

contract will achieve within some confidence interval (for example, 95, 97.5, or 99 percent confidence) based on the estimated distribution of the contract's possible values at each point in time over the time horizon, given historical changes in underlying risk factors. The specified percentile or confidence level of the distribution represents the maximum expected value of the contract at each point over the time horizon.

The time horizon used to calculate potential future exposure can vary depending on the bank's risk tolerance, collateral protection, and ability to terminate its credit exposure. Some institutions may use a time horizon equal to the life of the respective instrument. While such a time horizon may be appropriate for unsecured positions, for collateralized exposures, the use of lifetime, worst-case estimates of potential future exposure may be ineffective in measuring the true nature of counterparty risk exposure—especially given the increasing volatility and complexity of financial markets and derivatives instruments. While life-of-contract potential future exposure measures provide an objective and conservative long-term exposure estimate, they bear little relationship to the actual credit exposures banks typically incur in the case of collateralized relationships. In such cases, a bank's actual credit exposure is the potential future exposure from the time a counterparty fails to meet a collateral call until the time the bank liquidates its collateral—a period which is typically much shorter than the contract's life. For some institutions, more realistic measures of collateralized exposures in times of market stress are needed. These measures should take into account the shorter time horizons over which action can be taken to mitigate losses. They should also incorporate estimates of collateral-recovery rates given the impact of potential market events on the liquidity of collateral values.

Institutions with vigorous monitoring systems can employ additional credit-risk-measurement methodologies that will tend to generate more precise and often smaller reported exposure levels. Some institutions already calculate such measures by assessing the worst-case value of positions over a time horizon of one or two weeks—their estimate of a reasonable liquidation period in times of stress. Other institutions are moving to build the capability of estimating portfolio-based potential future exposures by any one of several different time horizons or buckets, owing to the liquidity and breadth of the underlying instrument or risk factor. Some institutions measure the "expected" exposure of a contract in addition to its maximum probable exposure. The expected exposure is the mean of all possible probability-weighted replacement costs estimated over the specified time horizon. This calculation may reflect a good estimate of the present value of the positive exposure that is likely to materialize. As such, expected exposure can be an important measure for use in an institution's internal pricing, limit-setting, and credit-reserving decisions. However, expected exposure is by definition lower than maximum probable exposure and may underestimate potential credit exposure. For this reason, expected exposure estimates are not frequently used as loan-equivalent amounts in assessing capital adequacy from either an internal or regulatory basis.

Statistically generated measures of future exposure use sophisticated risk-measurement models that, in turn, involve the use of important assumptions, parameters, and algorithms. Institutions using such techniques should ensure that appropriate controls are in place regarding the development, use, and periodic review of the models and their associated assumptions and parameters. The variables and models used for both replacement cost and potential exposure should be approved and tested by the credit-risk-management function and should be subject to audit by independent third parties with adequate technical qualifications. The data-flow process should also be subject to audit to ensure data integrity. Equally important are the approval and testing of information systems that report positions. The functions responsible for managing credit risk should validate any modifications to models made to accommodate new products or variations on existing products.

Aggregate Exposures

In measuring aggregate presettlement credit-risk exposures to a single counterparty, institutions may use either a transactions approach or a portfolio approach. Under a transactions approach, the loan-equivalent amounts for each derivative contract with a counterparty are added together. Some institutions may take a purely transactional approach to aggregation and do not incorporate the netting of long and short derivatives contracts, even when legally enforceable bilateral netting agreements are available. In such

cases, simple sum estimates of positive exposures may seriously overestimate true credit exposure, and examiners should monitor and encourage an institution's movement toward more realistic measures of counterparty exposure. When they exist, legally enforceable close-out netting agreements should be factored into these measurements, whatever approach is used to obtain them. Master close-out netting agreements are bilateral contracts intended to reduce presettlement credit risk in the event that a counterparty becomes insolvent before settlement. Upon default, the nondefaulting party nets gains and losses with the defaulting counterparty to a single payment for all covered transactions. All credit-risk-exposure measures should fully reflect the existence of such legally binding netting agreements as well as any other credit enhancements.

Some financial institutions measure potential credit-risk exposures on a portfolio basis, where information systems allow and incorporate netting (both within and across products, business lines, or risk factors) and portfolio correlation effects to construct a more comprehensive counterparty exposures measure. The portfolio approach recognizes the improbability that all transactions with a given counterparty will reach their maximum potential exposure at the same time as is implicitly assumed under the transactions approach. The portfolio approach uses simulation modeling to calculate aggregate exposures through time for each counterparty. As discussed in section 2070.1, "Legal Risk," gains and losses may be offset in measuring potential credit-risk exposure with the portfolio approach. If legally enforceable netting is not in place, then the sum of contracts with positive value under the simulation should be used as a measure of potential exposure. Contracts with negative value should only be considered as an offset for gains when netting is deemed to be legally enforceable. If executed correctly, the portfolio approach may provide a more realistic measurement of potential credit exposure for the portfolio than simply summing the potential worst-case exposures for each instrument in the portfolio. Whatever approach is used, the credit-risk-management function should clearly define the measurement aggregation methodology and apply it consistently across all instruments and types of capital-markets exposures.

In addition, examiners should ensure that an institution has adequate internal controls governing exposure estimation, including robust model-review processes and data integrity checks. Examiners should be aware that some banks may need to develop more meaningful measures of credit-risk exposures under volatile market conditions by developing and implementing timely and plausible stress tests of counterparty credit exposures. Stress testing should evaluate the impact of large market moves on the credit exposure to individual counterparties and on the inherent liquidation effects. Stress testing also should consider liquidity impacts on underlying markets and positions, and their effect on the value of any collateral received. Moreover, stress-testing results should be incorporated in senior management reports and provide sufficient information to trigger risk-reducing actions when necessary. Simply applying higher confidence intervals or longer time horizons to potential future exposure measures may not capture the market and exposure dynamics under turbulent market conditions, particularly as they relate to the interaction between market, credit, and liquidity risk. Examiners should determine whether stress testing has led to risk-reducing actions or a redefinition of the institution's risk appetite under appropriate circumstances.

Global Exposures

While an institution may use various methods to measure the credit exposure of specific types of instruments, credit exposures for both loans and capital-markets products should be consolidated by counterparty to enable senior management to evaluate the overall counterparty credit risk. To obtain an aggregate, institution-wide credit exposure for a customer in the global credit-risk-management system, many institutions use the risk in commercial loans as a base and convert credit-risk exposures in capital-markets instruments, both on- and off-balance-sheet, to the same base using loan-equivalent amounts. Together these two measures can be added to any other credit exposures to get the total credit exposure to a given counterparty.

CREDIT ENHANCEMENTS

As the derivatives market has expanded so has the number of market participants with lower credit ratings. Accordingly, institutions have

increased the use of credit enhancements in the derivatives marketplace. Some of the more common credit enhancements include the following:

- Collateral arrangements in which one or both counterparties agree to pledge collateral, usually consisting of cash or liquid securities, to secure credit exposures arising from derivative transactions.
- Special-purpose vehicles (SPVs) that can be separately capitalized subsidiaries or specially designed collateral programs organized to obtain a triple A counterparty credit rating.
- Mark-to-market cash settlement in which counterparties periodically mark transactions to market and make cash payments equal to their net present value, thus reducing any exposure to a preset threshold.
- Option-to-terminate or ''close out'' contracts which give either counterparty, after an agreed-upon interval, the option to instruct the other party to cash settle and terminate a transaction based on the transaction's net present value as quoted by agreed-upon reference dealers. The existence of the option allows both parties to view the transaction as having a maturity which is effectively reduced to the term of the option.
- Material-change triggers that convey the right to change the terms of or terminate a contract if a prespecified credit event occurs such as a rating downgrade, failure to pay or deliver, an adverse change in the counterparty's financial standing, or a merger event. Credit events may trigger the termination of a contract, the imposition of a collateral requirement, or stricter collateral terms.

Credit enhancements and other nonprice terms should be tailored to the counterparty and closely linked to assessments of counterparty credit quality.

Collateral Arrangements

Collateral arrangements are becoming an increasingly common form of credit enhancement in the derivatives market. There are generally two types of collateral arrangements. In the first type, the counterparty does not post collateral until exposure has exceeded a prespecified amount (threshold). The second type of collateral arrangement requires an initial pledge of liquid assets (initial margin) and often involves calls for additional collateral based on a periodic marking to market of the position. This type of arrangement is intended to reduce the frequency of collateral movements and protect the institution against unanticipated swings in credit exposure. Collateral agreements can require either one or both counterparties to pledge collateral. Increasingly, collateral arrangements are being formed bilaterally, where either counterparty may be asked to post collateral, depending on whose position is out of the money.

The use of collateral raises several important considerations. Similar to other credit enhancements, collateralization mitigates but does not eliminate credit risk. To the extent that collateral is sufficient, credit risk is transferred from the counterparty to the obligor of the collateral instrument. However, institutions should ensure that overreliance on collateralization does not compromise other elements of sound counterparty credit risk management, such as the due-diligence process. In addition, collateralization may reduce credit risk at the expense of increasing other risks, such as legal, operational, and liquidity risk. For instance, heavy reliance on collateral-management systems poses increased operational risk. Collateral agreements must be monitored, the collateral posted must be tracked and marked to market, and the physical safekeeping of the collateral must be ensured. Finally, the use of collateral is potentially more costly than other forms of credit enhancements, in part because it requires a substantial investment in systems and back-office support.

The fundamental aspects of a collateral relationship are usually specified in a security agreement or in the credit annex of a master netting agreement. The calculation of required collateral is usually based on the net market value of the portfolio. The amount of required collateral and appropriate margin levels are largely determined by the volatility of the underlying portfolio, the frequency of collateral calls, and the type of counterparty. In general, the higher the volatility of an underlying portfolio, the greater the amount of collateral and margin required. Frequent collateral calls will result in smaller amounts of margin and collateral posted. Institutions should be aware that if volatility increases beyond what is covered in the predetermined margin level, credit exposure to a counterparty may be greater than originally anticipated. For this reason, institutions generally revalue both the portfolio and the collateral regularly.

The amount of collateral and margining levels also should be based on the type of counterparty involved. Policies should not be overly broad so as to compromise the risk-reducing nature of collateral agreements with certain types of counterparties. Indeed, policies governing collateral arrangements should specifically define those cases in which initial and variation margin is required, and should explicitly identify situations in which lack of transparency, business-line risk profiles, and other counterparty characteristics merit special treatment. When appropriate to the risk profile of the counterparty, policies should specify when margining requirements based on estimates of potential future exposures might be warranted.

Securities that are posted as collateral are generally subject to haircuts, with the most liquid and least volatile carrying the smallest haircuts. Acceptable forms of collateral traditionally include cash and U.S. Treasury and agency securities. However, letters of credit, Eurobonds, mortgage-backed securities, equities, and corporate bonds are increasingly being considered acceptable collateral by some market participants. Institutions that actively accept collateral should ensure that haircuts for instruments accepted as collateral are reviewed at least annually to reflect their volatility and liquidity.

Collateral arrangements sometimes include rehypothecation rights, in which a counterparty repledges collateral to a third party. Institutions with rehypothecation rights may be exposed to the risk that the third party holding the rehypothecated collateral may fail to return the collateral or may return a different type of collateral. Institutions should ensure that they review the legal issues arising from collateral arrangements carefully, especially when rehypothecation rights are involved and when different locales can claim jurisdiction over determining the effectiveness of security interests. Rehypothecation of collateral may have an impact on a counterparty's right to set off the value of the collateral against amounts owed by a defaulting counterparty. In addition, institutions should review the laws of jurisdictions to which they are potentially subject to determine the potential effects of stays and the competing claims of other creditors on the enforcement of security interests.

Institutions with collateralization programs should establish policies and procedures that address position and collateral revaluations, the frequency of margin calls, the resolution of valuation disputes, the party holding the collateral, the window of time allowed for moving collateral, trigger thresholds, closeout rights, and rehypothecation. In addition, these policies and procedures should address the process of overriding credit limits, making margin calls, and waiving margin requirements.

In September 1998, the Committee of Payment and Settlement Systems and the Eurocurrency Standing Committee (now the Committee on the Global Financial System) of the central banks of the Group of Ten countries published a report entitled "OTC Derivatives Settlement Procedures and Counterparty Risk Management" that recommended that derivatives counterparties carefully assess the liquidity, legal, custody, and operational risks of using collateral. The report made the following specific recommendations to counterparties:

- Counterparties should review the backlogs of unsigned master agreements and outstanding confirmations and take appropriate steps to manage the risks effectively.
- Counterparties should assess the potential for reducing backlogs and associated risks through use of existing or new systems for the electronic exchange or matching of confirmations.
- Counterparties should assess the potential for clearinghouses for OTC derivatives to reduce credit risks and other counterparty risks, taking into account the effectiveness of the clearinghouse's risk-management procedures and the effects on contracts that are not cleared.

In March 1999, the International Swaps and Derivatives Association (ISDA) published its 1999 collateral review. The ISDA collateral review was an assessment of the effectiveness of existing collateral-management practices and recommendations for improvements in those practices. Among the market-practice recommendations for counterparties arising from the ISDA collateral review were the following:

- Counterparties should understand the role of collateral as a complement to, not a replacement for, credit analysis tailored to the risk profile presented by the counterparty, type of transaction, size of potential future exposure, term of risk, and other relevant factors.
- Counterparties should assess the secondary risks of collateralization, for example:

  — *Legal risk.* The risk that close-out netting

provisions under a master agreement are not enforceable upon the counterparty's insolvency, thus allowing the bankruptcy representative to ''cherry pick'' and repudiate contracts.
  - *Operational risk.* The risk that deficiencies in information systems or internal controls could result in losses.
  - *Credit risk.* Replacement-cost risk when a counterparty defaults prior to settlement, and settlement risk
  - *Correlation risk.* Default may be highly correlated with the market value of the contract, as was the case with dollar-denominated instruments held by counterparties in emerging-market countries.
  - *Liquidity risk.* Close-out provisions triggered by a ratings downgrade may create substantial liquidity demands at a time when meeting those demands is particularly costly.
- Counterparties should centralize and automate the collateral function and reconciliation procedures and impose a rigorous control environment.
- Counterparties should coordinate the collateral, payments, and settlement functions in order to maximize information flows regarding counterparties and markets in stress situations.
- Counterparties should consider the use of a wider range of assets as collateral and accept cash when a collateral-delivery failure occurs. (Counterparties often do not wish to accept cash because of the costs of reinvestment.)
- Counterparties should establish clear internal policies and methodologies for setting initial margins based on the volatility of the value of the derivative position.
- When setting haircut levels, counterparties should ensure that appropriate asset price volatility measures are considered over the appropriate timeframe.
- Counterparties should ensure that collateral agreements address the potential for changes in credit quality over the course of the transaction.

Other Credit Enhancements

Adequate polices should also govern the use of material-change triggers and close-out provisions, which should take into account counterparty-specific situations and risk profiles. For example, close-out provisions based on annual events or material-change triggers based on long-term performance may prove ineffective for counterparties whose risk profiles can change rapidly.

In evaluating an institution's management of its collateral arrangements and other credit enhancements, examiners should assess not only the adequacy of policies but should determine whether internal controls are sufficient to ensure that practices comply with these policies. Accordingly, in reviewing targeted areas dealing with counterparty credit risk management, examiners should identify the types of credit enhancements and contractual covenants used by an institution and determine whether the institution has sufficiently assessed their adequacy relative to the risk profile of the counterparty. Finally, examiners should be alert to situations in which collateralized exposures may be mis-estimated, and they should encourage management at these institutions to enhance their exposure-measurement systems and collateral-protection programs accordingly.

COUNTERPARTY ASSESSMENT

As with traditional banking transactions, an independent credit function should conduct an internal credit review before engaging in transactions with a prospective counterparty. Credit guidelines should be employed to ensure that limits are approved for only those counterparties that meet the appropriate credit criteria, incorporating any relevant credit support. The credit-risk-management function should verify that limits are approved by credit specialists with sufficient signing authority.

The quick credit-approval process often required in trading operations may lead financial institutions to conduct only summary financial analysis. Institutions should ensure that the level of financial analysis is adequate and that all transactions have formal credit approval. If the credit officers prefer not to establish a formal line for a new relationship, a transaction-specific written approval should be given based on the potential exposure from the transaction. In making such one-off approvals, credit officers and credit-risk management should keep settlement risks in mind.

Broad policies that were structured in the interests of flexibility to apply to all types of counterparties may prove inadequate for directing bank staff in the proper review of the risks posed by specific types of counterparties. The assessment of counterparties based on simple balance-sheet measures and traditional assessments of financial condition may be adequate for many types of counterparties. However, these assessments may be entirely insufficient for those counterparties whose off-balance-sheet positions are a source of significant leverage and whose risk profiles are narrowly based on concentrated business lines, such as with hedge funds and other institutional investors.

General policies calling for annual counterparty credit reviews are another example of broad policies that may compromise the integrity of the assessment of individual counterparties or types of counterparties—especially in cases when a counterparty's risk profile can change significantly over much shorter time horizons. Moreover, credit-risk assessment policies should also properly define the types of analysis to be conducted for particular types of counterparties based on the nature of their risk profile. In addition to customizing fundamental analyses based on industry and business-line characteristics of a counterparty, stress testing may be needed when a counterparty's creditworthiness may be adversely affected by short-term fluctuations in financial markets—especially when potential credit exposure to a counterparty increases when credit quality deteriorates.

A key responsibility of examiners has always been to identify areas where bank practices may not conform to stated policies. These efforts are made especially difficult when bank policies lack sufficient granularity, or specificity, to properly focus bank counterparty risk assessments. Accordingly, examiners should ensure that a bank's counterparty credit risk assessment policies are sufficiently defined to adequately address the risk profiles of specific types of counterparties and instruments. Policies should specify (1) the types of counterparties that may require special consideration; (2) the types and frequency of information to be obtained from such counterparties; (3) the types and frequency of analyses to be conducted, including the need for and type of any stress-testing analysis; and (4) how such information and analyses appropriately address the risk profile of the particular type of counterparty. This definition in policy is particularly important when limited transparency may hinder market discipline on the risk-taking activities of counterparties—which may have been the case with hedge funds.

Even when credit-risk assessment policies appear to be sufficiently defined, examiners should place increasing emphasis on ensuring that existing practice conforms with both the stated objectives and intent of the organization's established policies. Quite often, in highly competitive and fast-moving transaction environments, examiners found that the analyses specified in policies, such as the review of a counterparty's ability to manage the risks of its business, were not done or were executed in a perfunctory manner.

Necessary internal controls for ensuring that practices conform with stated policies include actively enforced documentation standards and periodic independent reviews by internal auditors or other risk-control units. Examiners should evaluate an institution's documentation standards and determine that internal reviews are adequately conducted for business lines, products, exposures to particular groups of counterparties, and individual customers that exhibit significant growth or above-normal profitability. As always, examiners should evaluate the integrity of these internal controls through their own transaction testing of such situations using targeted examinations and reviews. Testing should include robust sampling of transactions with an institution's major counterparties in the targeted area, as well as sufficient stratification to ensure that practices involving smaller relationships also adhere to stated policies.

In stratifying samples and selecting counterparties and transactions on which to base targeted testing of practices and internal controls, examiners should incorporate measures of potential future exposure, regardless of whether such exposures are collateralized. As evidenced in banks' experience with hedge fund relationships in 1998, meaningful counterparty credit risks during periods of stress can go undetected when only unsecured exposures are used in transaction testing.

OTC and Exchange-Traded Instruments

Assessing the financial health of counterparties is a critical element in effectively identifying and managing credit-risk exposures. Before con-

ducting transactions, institutions should conduct due-diligence assessments of their potential credit-risk exposure to all of the parties that might be involved in the transaction. For OTC transactions, this generally involves a single counterparty. For exchange-traded instruments, involved parties may include brokers, clearing firms, and the exchange's clearinghouse. In exchange-traded transactions, the clearinghouse guarantees settlement of all transactions.

An institution's policies should clearly identify criteria for evaluating and approving both OTC counterparties and, for exchange-traded instruments, all entities related to a transaction. For counterparties, brokers, and dealers, the approval process should include a review of their financial statements and an evaluation of the counterparty's ability to honor its commitments. An inquiry into the general reputation of the counterparty, dealer, or broker is also appropriate. At a minimum, institutions should consider the following in establishing relationships with counterparties and the dealers and brokers used to conduct exchange-traded transactions:

- the ability of the counterparty; broker; and clearinghouse and its subsidiaries, affiliates, or members to fulfill commitments as evidenced by capital strength, liquidity, and operating results
- the entity's general reputation for financial stability and fair and honest dealings with customers
- a counterparty's ability to understand and manage the risks inherent in the product or transaction
- information available from state or federal regulators, industry self-regulatory organizations, and exchanges concerning any formal

enforcement actions against the counterparty, dealer, broker, its affiliates, or associated personnel

With regard to exchange-traded transactions, institutions should assure themselves that sufficient safeguards and risk-management practices are in place at the involved entities to limit potential presettlement and settlement risk exposure. Exchange clearinghouses generally use a variety of safeguards to limit the likelihood of defaults by clearing members and ensure that there are adequate resources to meet any losses should a default occur. These safeguards can include (1) financial and operating requirements for clearinghouse membership, (2) margin requirements that collateralize current or potential future exposures and periodic settlements of gains and losses that are structured to limit the buildup of these exposures, (3) procedures that authorize resolution of a clearing member's default through close-out of its proprietary positions and transfer or close-out of its client's positions, and (4) the maintenance of supplemental clearinghouse resources (for example, capital, asset pools, credit lines, guarantees, or the authority to make assessments on nondefaulting members) to cover losses that may exceed the value of a defaulting member's margin collateral and to provide liquidity during the time it takes to realize the value of that margin collateral. Institutions should assure themselves of the adequacy of these safeguards before conducting transactions on exchanges.

Due diligence is especially important when dealing with foreign exchanges; institutions should be cognizant of differences in the regulatory and legal regimes in these markets. Substantial differences exist across countries, exchanges, and clearinghouses in fundamental areas such as mutualization of risk, legal relationships between the clearinghouse and its members, legal relationships between the clearinghouse and customers, procedures in the event of default, and segregation of customer funds. These considerations are particularly important for institutions such as futures commission merchants (FCMs) that conduct trades for customers.[1]

COUNTERPARTY CREDIT RISK LIMITS

Exposure-monitoring and limit systems are critical to the effective management of counterparty credit risk. Examiners should focus special attention on the policies, practices, and internal controls of banking institutions. An effective exposure-monitoring system consists of establishing meaningful limits on the risk exposures an institution is willing to take, independent ongoing monitoring of exposures against such limits, and adequate controls to ensure that reporting and meaningful risk-reducing action takes place when limits are exceeded. Since an effective exposure-monitoring and limit process depends on meaningful exposure-measurement methodologies, examiners should closely evaluate the integrity of these systems at institutions that may have inadequate exposure-measurement systems—especially regarding the estimation of potential future exposures. Overly conservative measures or other types of less-than-meaningful exposure measurements can easily compromise well-structured policies and procedures. Such situations can lead to limits being driven primarily by customer demand and used only to define and monitor customer facilities, instead of using limits as strict levels, defined by credit management, for initiating exposure-reducing actions.

Limits should be set on the amounts and types of transactions authorized for each entity before execution of any trade. Distinct limits for presettlement and settlement risk should be established and periodically reviewed and reconfirmed. Both overall limits and product sublimits may be established. For example, a customer may be assigned a foreign-exchange trading line, while interest-rate or cross-currency swaps are approved against the general line on a transaction-by-transaction basis. In some cases, the approach to assigning sublimits reflects the pace of transactions in the marketplace as well as the amount of credit risk (largely a reflection of tenor). The sum of product-specific sublimits may well exceed the aggregate limit, reflecting management's experience that all sublimits are not used simultaneously. In such cases, however, the organization should have sufficient monitoring of global credit exposures to detect a breach of the global limit.

The frequency with which credit exposures are monitored depends on the size of the trading and derivatives portfolios and on the nature of

1. See section 3030.1, "Futures Brokerage Activities and Futures Commission Merchants," as well as the Federal Reserve's *Bank Holding Company Supervision Manual*.

the trading activities. Active dealers should have counterparty credit exposure monitored daily. Irrespective of how credit exposure is monitored, the replacement cost should be calculated daily and compared to the approved potential exposure figure for validity.

Unusual market movements may lead to rapid accumulation of credit exposure. The creditworthiness of counterparties can also change. Between its regular reviews of credit exposures, the institution should have a mechanism that guarantees timely recognition of either unusual credit-exposure buildups or credit deterioration in a counterparty. For institutions that are dealers in these markets, the monitoring should be very frequent, and regular reviews should be conducted with the same frequency as for other significant credit customers.

Management should have procedures for controlling credit-risk exposures when they become large, a counterparty's credit standing weakens, or the market comes under stress. Management should show clear ability to reduce large positions. Common ways of reducing exposure include halting any new business with a counterparty and allowing current deals to expire, assigning transactions to another counterparty, and restructuring the transaction to limit potential exposure or make it less sensitive to market volatility. Institutions can also use many of the credit enhancement tools mentioned earlier to manage exposures that have become uncomfortably large.

INSTITUTIONAL INVESTORS AND HEDGE FUNDS

Examiners should pay increasing attention to the appropriateness, specificity, and rigor of the policies, procedures, and internal controls that institutions use in assessing, measuring, and limiting the counterparty credit risks arising from their trading and derivative activities with institutional investors in general, and particularly with hedge funds. In the area of counterparty assessment, institutions doing business with institutional investors and hedge funds should have sufficient information on which to assess the counterparty and its inherent risks, including information on total leverage, both on- and off-balance-sheet, and firm strategies. Banks should conduct in-depth due-diligence reviews of the effectiveness of a counterparty's risk-management systems and capabilities and its internal control environment to make effective decisions regarding the level of risk they are willing to assume. Institutions should be cautioned to obtain supporting documentation for the claims of fund managers.

Counterparty credit risk management should emphasize comprehensive stress testing across a variety of scenarios, with particular focus on possible asset or position concentrations. Institutions should also determine the investor's or fund's ability to stress test its portfolio. In limiting counterparty credit risks through the use of collateral and other credit enhancements, it should be recognized that standard arrangements that may be suitable for most counterparties may not be suitable for counterparties that have the potential to quickly change their portfolios, such as hedge funds. For example, 12-month rolling average close-out provisions may be inappropriate for counterparties engaged in active trading, where a prior month's gains can mask serious losses in the current month. Institutions that deal with institutional investors and hedge funds should have the policies, procedures, and internal controls in place to ensure that these exposures are measured, monitored, and controlled by management on an on-going basis.

The Basle Committee on Banking Supervision released a report that analyzed the risks posed by hedge funds to creditors and published sound practices standards for interactions with hedge funds. The sound practices standards identified areas in which bank practices could be enhanced, including—

- establishing clear policies and procedures that define the bank's risk appetite and drive the process for setting credit standards;
- obtaining adequate information on which to base sound judgments of counterparty credit quality;
- performing adequate due diligence, including setting standards for risk management by counterparties that are commensurate with the level of sophistication and complexity of their activities;
- developing meaningful limits for derivatives counterparties and more accurate measures of potential future exposure;
- adequately assessing and measuring unsecured exposures under collateralized derivatives transactions, and setting meaningful credit limits based on such assessments;

- adequately stress testing counterparty credit risk under a variety of scenarios that take into account liquidity effects, and incorporating results into management decisions about risk taking and limit setting;
- closely linking nonprice terms, including collateral arrangements and termination provisions, to assessments of counterparty credit quality; and
- timely monitoring counterparty transactions and credit exposures, including frequently reassessing banks' large exposures, counterparty leverage, and concentration of counterparty activities and strategies.

UNNAMED COUNTERPARTIES

Institutions that deal in products such as foreign exchange, securities, and derivatives sometimes face situations in which they are unaware of a counterparty's identity. Investment advisors or agents typically conduct trades on behalf of their investment-management clients and do not provide the names of the ultimate counterparty on the grounds of confidentiality. In this situation, the dealing institution will most likely never know the identity of its counterparties.

Because institutions may not be able to assess the creditworthiness of unnamed counterparties in advance, they should develop policies and procedures that define the conditions under which such transactions can be conducted. Exposures arising from these transactions should be closely monitored and controlled. Given the potential reputational risks involved, transactions with unnamed counterparties should be restricted to reputable agents and firms. Institutions with significant relationships with investment advisors who trade on behalf of undisclosed counterparties may wish to establish agency agreements with those advisors. These agreements can provide for a series of representations and warranties from the investment advisor on a variety of issues including compliance with local and national laws and regulations, particularly on money-laundering regulations.

Techniques used to reduce credit exposure to undisclosed counterparties include setting limits on the aggregate amount of business or on the types of instruments or transactions conducted with unnamed counterparties. In addition, institutions often pay particular attention when processing an agent's trades for an unnamed counterparty. An effective and efficient back-office process helps to ensure that the institution is aware of the size of such exposures on a timely basis.

Similarly, institutions often manage the settlement process with unnamed counterparties more closely than with traditional trading counterparties. Institutions often set settlement limits with unnamed counterparties so that large sums are not settled on a single day. Institutions sometimes develop procedures that ensure management is made immediately aware of settlement failures by unnamed counterparties.

BLOCK TRADES WITH INVESTMENT ADVISORS

Frequently, investment advisors or agents will bundle together trades for several clients, particularly in the case of mutual funds and hedge funds.[2] Most of these trades are accompanied by information about how the trade should be allocated among the funds for which it was executed, or they are subject to standing allocation information. Occasionally, investment advisors may fail to give institutions timely allocation information. Institutions should be concerned that such delays do not become habitual. When significant investment advisor relationships exist, institutions should adopt policies requiring that all transactions be allocated within some minimum period (for example, by the end of the business day). The credit department should be promptly notified of any exceptions to such policies.

Many institutions track the allocation arrangements made by investment advisors. While late allocations or frequent changes to allocation arrangements are often symptomatic of back-office problems at the investment advisor, they could also indicate that the investment advisor is engaging in unfair allocation.

Sometimes the allocations provided by investment advisors include counterparties that may

2. The Securities and Exchange Commission, in a number of no-action letters, has permitted this practice as long as the advisor does not favor any one client over another, has a written allocation statement before the bundled order was placed, and receives the client's written approval. See the SEC letters SMC Capital, Inc. (September 5, 1995); Western Capital Management, Inc. (August 11, 1977).

not have established credit lines with the institution. Institutions should endeavor to minimize such situations and may wish to limit the percentage of any trade that can be allocated to counterparties that do not have an existing credit line with the institution.

MANAGEMENT INFORMATION SYSTEMS

Management information systems (MIS) used to control counterparty credit risk include systems to monitor exposure levels; track customer limits and limit excesses; and, when used, value and track collateral. Important inputs to these systems include transaction data, current market values, and estimated potential credit exposures. The primary purpose of these systems is to provide comprehensive, accurate, and timely credit information to credit-risk-management personnel, front-office personnel, business-line and other senior management, and, ultimately, the board of directors. Institutions should ensure that their credit MIS are adequate for the range and scope of their trading and derivative activities and that there are appropriate controls in place to ensure the integrity of these systems. As part of the normal audit program, internal audit should review credit MIS to ensure their integrity.

A critical element of MIS is their timeliness in reflecting credit exposures. For derivative contracts, institutions should be able to update the current market values and potential credit exposures of their holdings throughout the life of a contract. The frequency of updates for credit-risk-management purposes often depends on the complexity of the product and the volume of trading activity. More sophisticated systems provide intraday exposure numbers that enable the front office to determine, without any additional calculations, whether a proposed deal will cause a credit excess.

Institutions that use collateral to manage credit risk usually maintain collateral-management systems for valuation and monitoring purposes. The sophistication of an institution's collateral management system should reflect the size of the collateral program, frequency of collateral revaluations and associated credit-exposure calculations, nature of collateral-posting events, and location of the collateral. The most effective collateral-management systems are global and have the ability to identify, post, value, stress test, and monitor collateral. When collateral-management systems are able to feed data into the front-office's credit-line-availability system, an institution can factor collateral into credit-approval decisions and, consequently, have a more accurate picture of unsecured credit risk.

Institutions often maintain databases that detail the extent to which netting is applicable for a given counterparty. Depending on whether netting is applicable, obligations are presented on a net or gross basis in credit-monitoring reports.

Credit MIS should furnish adequate reports to credit personnel and business-line management. Daily reports should address significant counterparty line usage and exceptions to limits. Less frequent reports on the maturity or tenor of credit exposures, sector and industry concentrations, trends in counterparty exposures, trends in limit excesses, ''watch lists,'' and other pertinent reports are also appropriate. Periodic summary reports on credit exposures should also be presented to senior management and the board.

DOCUMENTATION OF POLICIES AND PROCEDURES

Current and sufficient documentation is critical to the effective operation of a credit-risk-management program and is necessary to ensure that the program is consistent with the stated intentions of senior management and the board. The institution's credit policy manual is an important tool for both auditors and examiners, as well as an important resource for resolving any disputes between credit-risk management and traders or marketers.

All policies and procedures specific to credit-risk management for trading should be added to the financial institution's overall credit policy manual. Procedures should include limit-approval procedures, limit-excess and one-off approval procedures, exposure-measurement methodologies, and procedures for accommodating new products and variations on existing products. Policies should also address the methodologies for assessing credit-loss reserves for trading operations. When established, such reserves should take into account both current and potential future exposure. Credit-approval documentation should also be closely tracked by the credit-risk-management function. All limit approvals should be filed by counterparty and

made available to traders so that they know the available limit to a counterparty before entering into a deal. Signed over-limit or one-off approvals should also be tracked down and kept in a file for historical records. A log should be maintained for all missing signed approvals, and approvals for new products should be maintained.

1. To evaluate the organizational structure of the credit-risk-management function.
2. To evaluate the adequacy of internal credit-risk-management policies and procedures relating to the institution's capital-markets and trading activities and to determine that sufficient resources and adequate attention are devoted to the management of the risks involved in growing, highly profitable, or potentially high-risk activitivities and product lines.
3. To ensure that actual operating practices reflect such policies.
4. To identify the credit risks of the institution.
5. To determine if the institution's credit-risk-measurement system has been correctly implemented and adequately measures the institution's credit risks.
6. To determine if the institution's credit-risk-management processes achieve an appropriate balance among all elements of credit-risk management, including both qualitative and quantitative assessments of counterparty creditworthiness; measurement and evaluation of both on- and off-balance-sheet exposures, including potential future exposure; adequate stress testing; reliance on collateral and other credit enhancements; and the monitoring of exposures against meaningful limits.
7. To determine how the institution measures difficult-to-value exposures.
8. To determine if senior management and the board of directors of the institution understand the potential credit exposures of the capital-markets and trading activities of the institution.
9. To ensure that business-level management has formulated contingency plans in the event of credit deterioration and associated market disruptions.
10. To evaluate the adequacy of the policies, procedures, and legal and operational support relating to the institution's use of credit enhancements.
11. To determine if the institution has implemented adequate policies and procedures that are sufficiently calibrated to the risk profiles of particular types of counterparties and instruments to ensure adequate credit-risk assessment, exposure measurement, limit setting, and use of credit enhancements.
12. To ensure the comprehensiveness, accuracy, and integrity of management information systems that analyze credit exposures and to ensure that the methodology and automated processing can accommodate netting and other legal offset agreements, if applicable.
13. To determine if the institution's credit-risk-management system has been correctly implemented and adequately measures the institution's exposures.
14. To determine if the institution has an effective *global* risk-management system that can aggregate and evaluate market, liquidity, credit, settlement, operational, and legal risks, and that management at the highest level is aware of the institution's global exposure.
15. To determine if the institution is moving in a timely fashion to enhance its measurement of counterparty-credit-risk exposures, including the refinement of potential future exposure measures and the establishment of stress-testing methodologies that better incorporate the interaction of market and credit risks.
16. To recommend corrective action when policies, procedures, practices, internal controls, or management information systems are found to be deficient.

These procedures are processes and activities that may be considered in reviewing the credit-risk-management of trading and derivative operations. The examiner-in-charge will establish the general scope of examination and work with the examination staff to tailor specific areas for review as circumstances warrant. As part of this process, the examiner reviewing a function or product will analyze and evaluate internal audit comments and previous examination workpapers to assist in designing the scope of the examination. In addition, after a general review of a particular area to be examined, the examiner should use these procedures, to the extent they are applicable, for further guidance. Ultimately, it is the seasoned judgment of the examiner and the examiner-in-charge as to which procedures are warranted in examining any particular activity.

1. Review the credit-risk-management organization.
   a. Check that the institution has a credit-risk-management function with a separate reporting line from traders and marketers.
   b. Determine if credit-risk-control personnel have sufficient authority in the institution to question traders' and marketers' decisions.
   c. Determine if credit-risk management is involved in new-product discussions in the institution.
2. Identify the institution's capital-markets and trading activities and the related balance-sheet and off-balance-sheet instruments. Obtain copies of all risk-management reports prepared by the institution. Using this information, evaluate credit-risk-control personnel's demonstrated knowledge of the products traded by the institution and their understanding of current and potential exposures.
3. Obtain and evaluate the adequacy of risk-management policies and procedures for capital-markets and trading activities.
   a. Review credit-risk policies, procedures, and limits. Determine whether the risk-measurement model and methodology adequately address all identified credit risks and are appropriate for the institution's activities. Review the methodologies used to measure current exposure and potential exposure.
   b. Review credit-administration procedures.
      - Determine how frequently counterparty credit conditions are analyzed and lines reviewed. This should be done no less frequently than annually.
      - Assess whether management has demonstrated an ability to identify downgrades in creditworthiness between reviews.
      - Determine if credit-risk-management staff demonstrate an ability to work out of positions with counterparties whose credit quality has deteriorated.
      - Check that limits are in place for counterparties before transacting a deal. If the institution relies on one-off approvals, check that the approval process is as formal as that for counterparty limits.
   c. Review contingency credit-risk plans for adequacy.
   d. Review accounting and revaluation policies and procedures. Determine that revaluation procedures are appropriately controlled.
   e. Determine the extent to which management relies on netting agreements. Determine if aggregation of exposure assumes netting, and check that netting agreements are in place and that legal research is performed to justify management's confidence in the enforceability of the netting agreements.
4. Determine the credit rating and market acceptance of the institution as a counterparty in the markets.
5. Obtain all management information analyzing credit risk.
   a. Determine the comprehensiveness, accuracy, and integrity of analysis.
   b. Review valuation and simulation methods in place.
   c. Review stress tests analyzing changes in credit quality, including deterioration of credit due to changing macroeconomic conditions. Review stress-testing methodologies to determine the extent to which they incorporate both credit and market risk.
   d. Review potential future exposure calcu-

lations to determine whether they reflect realistic measures of exposure in both normal and stressed markets.

e. Determine whether the management information reports accurately reflect risks and whether reports are provided to the appropriate levels of management.

6. Determine if any of the institution's counterparties have recently experienced credit downgrades or deteriorations and whether the institution's trading activities have been affected. If so, determine the institution's response.
7. Review documentation that evidences credit-risk management's adherence to its program.
   a. Obtain copies of written approvals for limit excesses or one-off approvals. Determine the timeliness of these approvals.
   b. Select a sample of master agreements to ensure that each counterparty with whom management nets exposure for risk-management purposes has signed a master agreement. Review the master agreement aging report of unsigned master agreements to ensure adequate chasing procedures are in place.
8. Establish that the institution is following its internal policies and procedures. Determine whether the established limits adequately control the range of credit risks. Determine that the limits are appropriate for the institution's level of activity. Determine whether management is aware of limit excesses and takes appropriate action when necessary.
9. Determine whether the internal-audit and independent risk-management functions adequately focus on growth, profitability, and risk criteria in targeting their reviews.
10. Determine whether the institution has established an effective audit trail that summarizes exposures and management approvals with the appropriate frequency.
11. Determine that business managers have developed contingency plans which reflect actions to be taken in times of market disruption (and major credit deteriorations) to minimize losses as well as the potential damage to the institution's market-making reputation. These should include controls over the settlement process.
12. Obtain and evaluate the adequacy of policies and procedures relating to the institution's use of credit enhancements.
    a. Review collateralization policies and procedures.
       - Determine the frequency of margin calls and portfolio and collateral revaluations.
       - Ensure that legal agreements are in place and that the fundamental aspects of collateral relationships are specified in the agreements.
       - Review the policies for determining the types of acceptable collateral, haircuts on the collateral, and margin requirements.
    b. Determine whether the institution has rehypothecation rights. Determine whether appropriate policies and procedures are in place to manage the risks associated with collateral rehypothecation.
    c. Ensure that collateral-management systems and operational internal controls are fully documented and able to support the institution's credit enhancement activity.
13. Determine whether policies and procedures reflect the risk profiles of particular counterparties and instruments. If the institution trades with institutional investors, hedge funds, or unnamed counterparties, determine if the institution has an overall limit on trading with these types of counterparties.
14. Determine whether appropriate policies and procedures are in place if the institution engages in block trades with investment advisors.
    a. Determine if the institution has a policy that all trades not allocated at the time of the trade must be allocated by the end of the trading day. Determine whether exceptions to such a policy are monitored by the credit area.
    b. Determine how the institution deals with investment advisors who are habitually late with allocation information.
    c. Determine whether the institution limits the percentage of a block trade that can be allocated to counterparties without credit lines.
15. Recommend corrective action when policies, procedures, practices, internal controls, or management information systems are found to be deficient.

1. Review the credit-risk-management organization.
   a. Does the institution have a credit-risk-management function with a separate reporting line from traders and marketers?
   b. Do credit-risk-control personnel have sufficient credibility in the institution to question traders' and marketers' decisions?
   c. Is credit-risk management involved in new-product discussions in the institution?
2. Identify the institution's capital-markets and trading activities and the related balance-sheet and off-balance-sheet instruments and obtain copies of all risk-management reports prepared.
   a. Do summaries identify all the institution's capital-markets products?
   b. Define the role that the institution takes for the range of capital-markets products. Determine the instruments used to hedge these products. Is the institution an end-user, dealer, or market maker? If so, in what products?
   c. Do credit-risk-control personnel demonstrate knowledge of the products traded by the institution? Do they understand the current and potential exposures to the institution?
3. Does the institution have comprehensive, written risk-management policies and procedures for capital-markets and trading activities?
   a. Review credit-risk policies and procedures.
      • Do the risk-measurement model and methodology adequately address all identified credit risks? Are the risk-measurement model and methodology appropriate for the institution's activities?
      • Do the policies explain the board of directors' and senior management's philosophy regarding illiquid markets and credit events (downgrades/deteriorations)?
   b. Review credit-administration procedures.
      • Are counterparty credit conditions analyzed and lines reviewed with adequate frequency? (This should be done no less frequently than annually.)
      • Can management identify downgrades in creditworthiness between reviews?
      • Has credit-risk-management staff demonstrated an ability to work out of positions with counterparties whose credit quality has deteriorated?
      • Are limits in place for counterparties before transacting a deal? If the institution relies on one-off approvals, is the approval process as formal as that for counterparty limits?
   c. Have limits been approved by the board of directors?
   d. Have policies, procedures, and limits been reviewed and reapproved within the last year?
   e. Are credit-risk policies, procedures, and limits clearly defined?
   f. Are the credit limits appropriate for the institution and its level of capital?
   g. Are there contingency credit-risk plans?
   h. Are there appropriate accounting and revaluation policies and procedures?
   i. Does management rely on netting agreements?
      • Does aggregation of exposure assume netting?
      • Are netting agreements in place and has legal research been performed to justify management's confidence in the enforceability of the netting agreements?
4. Has there been a credit-rating downgrade for the examined institution? What has been the market response to the financial institution as a counterparty in the markets?
5. Obtain all management information analyzing credit risk.
   a. Is management information comprehensive and accurate and is the analysis sound?
   b. Are the simulation assumptions for a normal market scenario reasonable?
   c. Are stress tests analyzing changes in credit quality appropriate? Are the market assumptions reasonable given credit deterioration of concentrations? Do stress-testing methodologies incorporate both credit and market risk?
   d. Are calculations of potential future exposure realistic in both normal and stressed markets?

   e. Do management information reports accurately reflect risks? Are reports provided to the appropriate levels of management?
6. Have any of the institution's counterparties recently experienced credit downgrades or deteriorations? If so, how have the institution's trading activities been affected and what was the institution's response?
7. Review documentation that evidences credit management's adherence to its program.
   a. Does the institution maintain copies of written approvals for limit excesses or one-off approvals? Are these prepared in a timely manner?
   b. Obtain a sample of master agreements. Are they appropriately signed? Are they signed in a timely manner? Does the institution have an appropriate chasing process to follow up on unsigned master agreements?
8. Is the institution following its internal policies and procedures? Do the established limits adequately control the range of credit risks? Are the limits appropriate for the institution's level of activity? Is management aware of limit excesses? Does management take appropriate action when necessary?
9. Do the internal audit and independent risk-management functions adequately focus on growth, profitability, and risk criteria in targeting their reviews?
10. Has the institution established an effective audit trail that summarizes exposures and management approvals with the appropriate frequency? Are risk-management, revaluations, and closeout valuation reserves subject to audit?
11. If any recent market disruptions affected the institution's trading activities, what has been the institution's market response?
12. Does the institution have comprehensive written policies and procedures relating to its use of credit enhancements?
   a. Does the institution revalue collateral and positions with adequate frequency?
   b. Are the fundamental aspects of collateral relationships reflected in legal agreements?
   c. Does the institution have policies specifying the types of acceptable collateral, haircuts on the collateral, and margin requirements? How often are these policies reviewed by management?
   d. Does the institution have rehypothecation rights?
      - Does the institution have policies and procedures in place to manage the risk that a third party holding rehypothecated collateral may fail to return the collateral or may return a different type of collateral?
      - Does the institution have measures in place to protect its security interest in the rehypothecated collateral?
   e. Do material-change triggers and closeout provisions take into account counterparty-specific situations and risk profiles?
   f. Are the collateral-management system and operational environment able to support the institution's collateral activity?
13. Does the institution trade with institutional investors, hedge funds, or unnamed counterparties?
   a. Does the institution place an overall limit on trading with these types of counterparties?
   b. Are credit officers aware of all cases in which a counterparty's identity is unknown?
14. Does the institution engage in block trades with investment advisors?
   a. Does the institution have a policy that all trades not allocated at the time of the trade must be allocated by the end of the trading day? Are exceptions to the policy monitored closely by the credit area?
   b. How does the institution deal with investment advisors who are habitually late with allocation information?
   c. Does the institution limit the percentage of a block trade that can be allocated to counterparties without credit lines?
15. Do policies and procedures generally reflect the risk profiles of particular counterparties and instruments?

Settlement risk is the risk of loss when an institution meets its payment obligation under a contract (through either an advance of funds or securities) before its counterparty meets a counterpayment or delivery obligation. Failures to perform at settlement can arise from counterparty default, operational problems, market liquidity constraints, and other factors. Settlement risk exists for any traded product and is greatest when delivery is made in different time zones. For banking institutions, foreign-exchange (FX) transactions are, perhaps, the greatest source of settlement-risk exposure. For large, money-center institutions, FX transactions can involve sizable credit exposures amounting to tens of billions of dollars each day. Accordingly, although the following general guidance can be applied to the settlement of all types of traded instruments, it focuses primarily on the settlement risks involved in FX transactions.

Settlement risk has a number of dimensions that extend beyond counterparty credit risk to include liquidity, legal, operational, and systematic risks. Even temporary delays in settlement can expose a receiving institution to liquidity pressures if unsettled funds are needed to meet obligations to other parties. Such liquidity exposure can be severe if the unsettled amounts are large and alternative sources of funds must be raised at short notice in turbulent or unreceptive markets. In an extreme example, the financial failure of a counterparty can result in the loss of the entire amount of funds.

As with other forms of credit risk, settlement risk should be managed through a formal and independent process with adequate senior management oversight and should be guided by appropriate polices, procedures, and exposure limits. Measurement systems should provide appropriate and realistic estimates of the settlement exposures and should use generally accepted measurement methodologies and techniques. The development of customer credit limits and the monitoring of exposures against those limits is a critical control function and should form the backbone of an institution's settlement-risk-management process.

This section discusses settlement risks involved in trading activities, especially as they apply to FX transactions. A primary reference for this material is the 1996 report of the Committee on Payment and Settlement Systems of the central banks of the Group of Ten Countries, ''Settlement in Foreign Exchange Transactions,'' which was prepared under the auspices of the Bank for International Settlements. In addition, the Board issued a policy statement, effective January 4, 1999, that addresses risks relating to private multilateral settlement systems (63 FR 34888, June 26, 1998).

SETTLEMENT-RISK-MANAGEMENT ORGANIZATION

An institution's process and program for managing its settlement risks should be commensurate with the range and scope of its activities. Institutions with relatively small trading operations in noncomplex instruments may not need the same level of automated systems, policies, and staff skills as do firms that are heavily engaged in FX transactions and other trading activities.

The management of settlement risk should begin at the highest levels of the organization, with senior management exercising appropriate oversight of settlement exposures. Although the specific organizational approaches may vary across institutions, managing settlement risk for FX and other trading activities should be integrated into the overall risk management of the institution to the fullest extent practicable. Settling transactions can involve many different functional areas of an institution, including trading, credit, operations, legal, risk assessment, branch management, and correspondent relations. Only senior management can effect the coordination necessary to define, measure, manage, and limit settlement risks across such varied functions. Accordingly, senior management should ensure that they fully understand the settlement risks incurred by the institution and should clearly define lines of authority and responsibility for managing these risks so that priorities, incentives, resources, and procedures across different areas can be structured to reduce exposures and mitigate risks. Staff responsible for all aspects of settlement-risk management should be adequately trained.

Measuring FX Settlement Exposures

Settlements generally involve two primary

events: the transmission of payment orders and the actual advance or receipt of funds. In FX transactions, it is important to distinguish a payment order, which is an instruction to make a payment, from the payment, which involves an exchange of credits and debits on the accounts of a correspondent bank or the accounts of a central bank when an interbank transfer takes place. To avoid paying late delivery fees, banks try to send their orders to their back office, branch, or correspondent bank on the day of trade or the next day. Since spot FX transactions generally call for settlement on the second day after the trade, orders are transmitted one or two days before settlement. On settlement day, payment orders are routed to the receiving institution through its correspondent or through the domestic payment system for actual final payment. Final payment may also be made through book-entry transfer if the two trading banks use a common correspondent.

A bank's settlement exposure runs from the time that its payment order for the currency sold can no longer be recalled or canceled with certainty and lasts until the time that the currency purchased is received with finality. In general, book-entry payments provide somewhat greater flexibility in terms of the ability to cancel a transfer because their processing does not rely on domestic payment systems. However, even the cancellation of book-entry transfers is still subject to restrictions presented by an institution's internal processing cycles and communication networks as well as time zone differences between branch locations. In theory, institutions may retrieve and cancel payment orders up until the moment before the funds are finally paid to a counterparty. However, many institutions have found that operational, economic, and even legal realities may result in payment orders becoming effectively irrevocable one or two business days before settlement day.

Institutions should specifically identify the actual time past which they can no longer stop a payment without the permission of a third party. This time is termed the unilateral cancellation deadline and should be used as a key parameter in assessing settlement-risk exposure. The documentation covering a correspondent's service agreement generally identifies these cutoff times. In the event of a dispute, a correspondent is likely to use the contractually agreed-upon unilateral cancellation deadline as a binding constraint.

The effect of an institution's internal processing patterns on its settlement risk should also be considered. The interval from the unilateral cancellation deadline for sold currency until final receipt of bought currency is generally referred to as the period of irrevocability. The full face value of the trade is at risk and the exposure on this amount can last overnight and up to one or two full days. If weekends and holidays are included, the exposure can exist for several days. The total exposures outstanding during this interval constitutes an institution's minimum FX settlement exposure.

The process of reconciling payments received with expected payments can also be a significant source of settlement-risk exposure. Many institutions may not perform this exercise until the day after settlement. During this interval, there is uncertainty as to whether the institution has received payments from particular counterparties. This period of uncertainty can create increased exposure, if it extends past the unilateral cancellation deadline for payments on the following day. For example, if an institution is subject to a unilateral cancellation deadline of 3:00 a.m. on settlement day and payments from the prior day's settlements are not reconciled until mid-morning on the day following settlement, it may be too late to manage its payments exposure for that following day. In this case, the maximum exposure from the evening of settlement day to morning on the following day can amount to both the receipts expected on settlement day (since their receipt has not been reconciled) and the entire amount of the following day's settlements (since they cannot be recalled.) In effect, an estimation of worst-case or maximum settlement exposures involves adding the exposures outstanding during the period of irrevocability to the exposures outstanding during the period of uncertainty. In a worst-case situation, a bank might find itself in the position of having sent out payments to a counterparty on one day when it had not been paid on the previous day.

Many institutions commonly define and measure their daily settlement exposures as the total receipts coming due that day. In some cases, this technique may either understate or overstate exposures. Simple measures using multiples of daily receipts can also incorrectly estimate risk. For example, using simple ''rules of thumb'' of two or three days of receipts may not sufficiently account for the appropriate timing of the settlement processing across different currencies.

Appropriately measuring FX settlement exposures requires an institution to explicitly identify both the unilateral cancellation deadlines and the reconciliation process times involved in each type of currency transaction. Accordingly, any simple rules used to measure settlement exposures should be devised in such a way as to consider both the unilateral cancellation deadlines and the reconciliation process involved in settlement. Identifying the duration of the settlement process and the related exposures does not require real-time tracking of all payments and can be accomplished through estimations based on standard settlement instructions and an understanding of the key milestones in the settlement process. Institutions should have a clear means of reflecting this risk in their exposure measurements.

Explicit consideration of unilateral cancellation deadlines and the reconciliation process can help an institution identify areas for improvement. If the time from its unilateral cancellation deadline to reconciliation can be reduced to under 24 hours, then an exposure measure of one day's receivables may provide a reasonable approximation of the duration and size of the settlement exposure to a counterparty. However, even then it must be recognized that overnight and weekend exposure may remain and that different currency pairs may require different intervals, which might overlap.

Limits

Institutions should ensure that settlement exposures to counterparties are properly limited. FX settlement exposures should be subject to an adequate credit-control process, including credit evaluation and review and determination of the maximum exposure the institution is willing to take with a particular counterparty bank. The process is most effective when the counterparty's FX settlement exposure limit is subject to the same procedures used to devise limits on exposures of similar duration and size to the same counterparty. For example, in cases where the FX settlement exposure to a counterparty lasts overnight, the limit might be assessed in relation to the trading bank's willingness to lend fed funds on an overnight basis.

Examiners should verify that the firm has set up separate presettlement and settlement lines for counterparties. Settlement exposures may also be broken down into sublimits by product. Sublimits may also be specified by date since settlement risk tends to be highest on the date of settlement.

Effective monitoring of exposures is crucial to the management of settlement risk, and institutions with large settlement exposures should strive to monitor payment flows on a real-time basis. Institutions should look to reduce settlement risk by arranging with their correspondents and counterparties to minimize, as much as practicable, the timing of an exchange of payments. Collateral arrangements and net settlement agreements are also important settlement-risk-management tools.

The timely reconciliation of nostro accounts also helps to mitigate settlement risk. Institutions often assume they have settlement exposure until they can confirm final receipt of funds or securities. Timely reconciliation enables an institution to determine its settlement exposure accurately and make informed judgments about its ability to assume additional settlement risk.

Procedures

From time to time, institutions may misdirect their payments, and funds may fail to arrive in promptly. While such mistakes may be inadvertent and corrected within a reasonable time, institutions should have procedures for quickly identifying fails, obtaining the funds due, and taking steps to avoid recurrences. Some institutions deduct fails from counterparty limits and review a series of fails to determine whether their pattern suggests that the problem is not procedural.

Netting

Banks can reduce the size of their counterparty exposures by entering into legally binding agreements for the netting of settlement payments. (Netting of payment obligations should not be confused with the more common netting of mark-to-market credit exposures of outstanding contracts such as swaps and forward FX.) Common arrangements involving bilateral netting of settlement flows, including FXNet, ValueNet, and Swift Accord, and bilateral agreements following IFEMA or other contracts. Legally binding netting arrangements permit banks to

offset trades against each other so that only the net amount in each currency must be paid or received by each bank to its netting counterparts. Depending on trading patterns, netting can significantly reduce the value of currencies settled. Netting also reduces the number of payments to one per currency either to or from the counterparty.

Netting is most valuable when counterparties have a considerable two-way flow of business. As a consequence, netting may only be attractive to the most active institutions. To take advantage of risk-reducing opportunities, institutions should have a process for identifying attractive netting situations that would provide netting benefits that outweigh the costs involved.

Some banks use the procedure of informal payment netting. Based on trading patterns, back offices of each counterparty will confer by telephone on the day before settlement and agree to settle only the net amount of the trades falling due. Since there may not be a legal opinion underpinning such procedures, institutions should ensure that they develop a good understanding of their ability to manage the legal, credit, and liquidity risks of this practice.

Multilateral Settlement Systems

The use of multilateral settlement systems by institutions raises additional settlement risks insofar as the failure of one system participant to settle its obligations when due can have credit or liquidity effects on participants that have not dealt with the defaulting participant. The Board's recent Policy Statement on Privately Operated Multilateral Settlement Systems provides guidance on the risks of these systems. The policy statement applies to systems with three or more participants that settle U.S. dollar payments with an aggregate gross value of more than $5 billion on any one day. However, the principles set forth in the policy statement can be used to evaluate risks in smaller systems.

The policy statement addresses the credit, liquidity, operational, and legal risks of multilateral settlement systems and provides risk-management measures for consideration. The policy statement is intended to provide a flexible, risk-based approach to multilateral settlement system risk management and should not be interpreted as mandating uniform, rigid requirements for all systems under its purview.

Risk-management measures to mitigate credit risk include monitoring participants' financial condition; setting caps or limits on some or all participants' positions in the system; and requiring collateral, margin, or other security. To mitigate liquidity risk, institutions operating multilateral settlement systems may also consider external liquidity resources and contingency arrangements. Liquidity risk also is mitigated by timely notification of settlement failures to enable participants to borrow funds to cover shortfalls. Operational risks are mitigated by contingency plans, redundant systems, and backup facilities. Legal risks are mitigated by operating rules and participant agreements, especially when transactions are not covered by an established body of law.

Large multilateral settlement systems also must meet the more comprehensive requirements of the Lamfalussy Minimum Standards established by the central banks of the Group of Ten countries. Under the policy statement, in determining whether a system must meet the Lamfalussy Minimum Standards, the Board will consider whether the system settles a high proportion of large-value interbank or other financial market transactions, has very large liquidity exposures that have potentially systemic consequences, or has systemic credit exposures relative to the participants' financial capacity.

Contingency Planning

Contingency planning and stress testing should be an integral part of the settlement-risk-management process. Contingencies should be established to span a broad spectrum of stress events, ranging from internal operational difficulties to individual counterparty defaults to broad market-related events. Adequate contingency planning in the FX settlement-risk area includes ensuring timely access to key information such as payments made, received, or in process; developing procedures for obtaining information and support from correspondent institutions; and well-defined procedures for informing senior management about impending problems.

Internal Audit

Institutions should have in place adequate internal audit coverage of the settlement areas to

ensure that operating procedures are adequate to minimize exposure to settlement risk. The scope of the FX settlement internal audit program should be appropriate to the risks associated with the market environment in which the institution operates. The audit frequency should be adequate for the relevant risk associated with the FX settlement area. Most institutions base audit frequency on a risk-assessment basis, and examiners should consult with the internal audit examiner to determine the adequacy of the risk-assessment methodology used by the institution.

Audit reports should be distributed to appropriate levels of management, who should take appropriate corrective action to address findings pointed out by the internal audit department. Audit reports should make recommendations for minimizing settlement risk in cases where weaknesses are cited. Management should provide written responses to internal audit reports, indicating its intended action to correct deficiencies where noted.

When audit findings identify areas for improvement in the FX settlement area, other areas of the institution on which this may have an impact should be notified. This could include credit-risk management, reconciliations/accounting, systems development, and management information systems. In automated FX settlement processing, the internal audit department should have some level of specialization in information technology auditing, especially if the institution maintains its own computer facility.

Management Information Systems

In larger, more complex institutions, counterparty exposures and positions can run across departments, legal entities, and product lines. Institutions should have clearly defined methods and techniques for aggregating exposures across multiple systems. In general, automated aggregation produces fewer errors and a higher level of accuracy in a more timely manner than manual methods.

The institution should have a contingency plan in place to ensure continuity of its FX settlement operations if its main production site becomes unusable. This plan should be documented and supported by contracts with outside vendors, where appropriate. The plan should be tested periodically.

Institutions face two types of liquidity risk in their capital-markets and trading activities: ''Funding-liquidity risk'' refers to the ability to meet investment and funding requirements arising from cash-flow mismatches, and ''market-liquidity risk'' is the risk that an institution cannot easily eliminate or offset a particular position without significantly affecting the previous market price because of inadequate market depth or market disruption. Measuring, monitoring, and addressing both types of liquidity-risk exposures are vital activities of a financial institution. Ultimate responsibility for setting liquidity policies and reviewing liquidity decisions lies in the financial institution's highest level of management, and its decisions should be reviewed periodically by the board of directors.

In developing guidelines for controlling liquidity risks, institutions should consider the possibility that they could lose access to one or more markets because of concerns about the institution's own creditworthiness, the creditworthiness of a major counterparty, or generally stressful market conditions. At such times, the institution may have less flexibility in managing its market-, credit-, and liquidity-risk exposures. Institutions that make markets in over-the-counter derivatives or that dynamically hedge their positions require constant access to financial markets, and that need may increase in times of market stress. The institution's liquidity plan should reflect the institution's ability to turn to alternative markets, such as futures or cash markets, or to provide sufficient collateral or other credit enhancements to continue trading under a broad range of scenarios.

Examiners should ensure that financial institutions that participate in over-the-counter derivative markets adequately consider the potential liquidity risk associated with the early termination of derivative contracts. Many forms of standardized contracts for derivatives transactions allow counterparties to terminate their contracts early if the institution experiences an adverse credit event or a deterioration in its financial condition. Under conditions of market stress, customers may also ask for the early termination of some contracts within the context of the dealer's market-making activities. In these situations, an institution that owes money on derivative transactions may be required to settle a contract early and possibly at a time when the institution may face other funding and liquidity pressures. Furthermore, early terminations may expose additional market positions. Management and directors should be aware of these potential liquidity risks and address them in the liquidity plan and management process. Examiners should consider the extent to which such potential obligations could present liquidity risks to the institution.

FUNDING-LIQUIDITY RISK

Funding-liquidity risk refers to the ability to meet investment and funding requirements arising from cash-flow mismatches. Virtually every financial transaction or commitment has implications for an institution's liquidity. Traditionally, funding-liquidity-risk management focused on the balance-sheet activities of financial institutions; however, the major growth in off-balance-sheet activities in recent years has made liquidity management of these exposures increasingly important. Activities such as foreign-exchange, securities, and derivatives trading can have an important impact on a financial institution's liquidity.

The ability of a financial institution to raise funds in the wholesale marketplace can be influenced by systemic factors, which affect the spectrum of market participants, as well as weaknesses confined to the individual institution, such as a real or perceived decline in its credit quality. The perception that a financial institution's credit quality is declining can have a dramatic impact on its wholesale funding capabilities. Additionally, customers may wish to reduce or eliminate their exposures to the institution by unwinding their in-the-money positions. (In this instance, the customers' in-the-money position refers to contracts with a positive value to the customer; the position would be out-of-the-money to the financial institution.) While not necessarily obligated to unwind positions, the institution may feel compelled to accommodate its counterparties if it perceives that a continued presence as an active market maker is required to avoid damaging its market-making reputation. Similarly, to the extent that the institution has entered into transactions documented with agreements containing margin

or collateralization provisions in favor of the counterparty, or has granted the counterparty the right to terminate the contract under certain conditions, the institution may be legally obligated to provide cash or cash-equivalent collateral to in-the-money counterparties. Correspondingly, the institution's ability to collect margin or collateral from its customers on its in-the-money positions may be affected by the ability of its counterparties to perform.

Management Information Systems

Virtually all financial institutions have a staff dedicated to measuring and managing the institution's liquidity. Generally, the management information systems designed for liquidity measurement should relate to the level of the activities of the financial institution. An institution's investment in information systems designed to gather liquidity information on balance-sheet and off-balance-sheet exposures may be substantial for firms actively involved in the marketplace, especially if these activities are conducted globally. Correspondingly, financial institutions who are primarily end-users of off-balance-sheet products may have less sophisticated systems. Cash-flow projections should always incorporate all significant cash-flow sources and uses resulting from on- *and* off-balance-sheet activities. For institutions operating in a global environment, these projections should also reflect various foreign-currency funding requirements.

Management information systems should also be able to project cash flows under a variety of scenarios, including (1) a ''business-as-usual'' approach, which establishes the benchmark for the ''normal'' behavior of cash flows of the institution; (2) a liquidity crisis confined to the institution; and (3) a systemic liquidity crisis, in which liquidity is affected at all financial institutions. While the magnitude and direction of net cash positions can be forecast, it will fluctuate with changes in the market and activity in the portfolios.

As in other areas of risk management, liquidity-information systems and the liquidity-management process should be subject to audit. The examiner should ensure that the overall liquidity-risk-management process takes into account the risks in trading activities, especially when those activities are substantial, and the firm is a market maker. Evidence of analysis should be available for examiner review. A more detailed discussion of funding-liquidity risk can be found in the *Commercial Bank Examination Manual*.

Contingency Funding Plans

The complexity of large trading portfolios can make liquidity and cash-flow management difficult. For example, as market prices change, required adjustments to hedge ratios, variation margin calls, and customers' exercise of options may cause a portfolio that is hedged and solvent in a present-value sense to experience, at a point in time, a shortfall of cash inflows over outflows—thus creating a liquidity squeeze. Even if its portfolio is solvent, a financial institution may be unable to borrow to cover the cash-flow asymmetry because the complexity of the portfolio can obscure its true financial condition from potential lenders, making it appear too risky for lenders to quickly approve an urgent request for funds. For a financial institution with insufficient liquid assets, this cash-flow-management problem adds to the dimensions over which a portfolio must be managed.

In addition to liquidity-management-information systems, management should operate under comprehensive contingency funding plans. These plans should address both confined as well as systemic liquidity problems, which may be temporary or enduring. Courses of action under both scenarios should be outlined and management responsibilities well defined.

MARKET-LIQUIDITY RISK

Market-liquidity risk refers to the risk of being unable to close out open positions quickly enough and in sufficient quantities at a reasonable price. In dealer markets, the size of the bid/ask spread of a particular instrument provides a general indication as to the depth of the market under normal circumstances. However, disruptions in the marketplace, contraction in the number of market makers, and the execution of large block transactions are some factors which may result in the widening of bid/ask spreads.

Disruptions in various financial markets may have serious consequences for a financial institution that makes markets in particular instru-

ments. These disruptions may be specific to a particular instrument, such as those created by a sudden and extreme imbalance in the supply and demand for a particular product. Alternatively, a market disruption may be all-encompassing, such as the stock market crash of October 1987 and the associated liquidity crisis.

The decision of major market makers to enter or exit specific markets may also significantly affect market liquidity, resulting in the widening of bid/ask spreads. The liquidity of certain markets may depend significantly on the active presence of large institutional investors; if these investors pull out of the market or cease to trade actively, liquidity for other market participants can decline substantially.

Market-liquidity risk is also associated with the probability that large transactions in particular instruments, by nature, may have a significant effect on the transaction price. Large transactions can strain liquidity in markets that are not deep. Also relevant is the risk of an unexpected and sudden erosion of liquidity, possibly as a result of a sharp price movement or jump in volatility. This could lead to illiquid markets, in which bid/ask spreads are likely to widen, reflecting declining liquidity and further increasing transaction costs.

Over-the-Counter Instruments

Market liquidity in over-the-counter (OTC) dealer markets depends on the willingness of market participants to accept the credit risk of major market makers. Changes in the credit risk of major market participants can have an important impact on the liquidity of the market. Market liquidity for an instrument may erode if, for example, a decline in the credit quality of certain market makers eliminates them as acceptable counterparties. The impact on market liquidity could be severe in those OTC markets in which a particularly high proportion of activity is concentrated with a few market makers. In addition, if market makers have increased concerns about the credit risk of some of their counterparties, they may reduce their activities by reducing credit limits, shortening maturities, or seeking collateral for security—thus diminishing market liquidity.

In the case of OTC off-balance-sheet instruments, liquid secondary markets often do not exist. While cash instruments can be liquidated and exchange-traded instruments can be closed out, the ability to effectively unwind OTC derivative contracts is limited. Many of these contracts tend to be illiquid, since they can generally only be canceled by an agreement with the counterparty. Should the counterparty refuse to cancel the open contract, the financial institution could also try to arrange an assignment whereby another party is ''assigned'' the contract. Contract assignments, however, can be difficult and cumbersome to arrange. A financial institution's ability to cancel these financial contracts is a critical determinant of the degree of liquidity associated with the instruments. Financial institutions which are market makers, therefore, typically attempt to mitigate or eliminate market-risk exposures by arranging OTC contracts with other counterparties executing hedge transactions on the appropriate exchanges, or, most typically, a combination of the two.

In using these alternative routes, the financial institution must deal with two or more times the number of contracts to cancel its risk exposures. *While market-risk exposures can be mitigated or completely canceled in this manner, the financial institution's credit-risk exposure increases in the process.*

Exchange-Traded Instruments

For exchange-traded instruments, counterparty credit exposures are assumed by the clearinghouse and managed through netting and margin arrangements. The combination of margin requirements and netting arrangements of clearinghouses is designed to limit the spread of credit and liquidity problems if individual firms or customers have difficulty meeting their obligations. However, if there are sharp price changes in the market, the margin payments that clearinghouses require to mitigate credit risk can have adverse effects on liquidity, especially in a falling market. In this instance, market participants may sell assets to meet margin calls, further exacerbating liquidity problems in the marketplace.

Many exchange-traded instruments are liquid only for small lots, and attempts to execute a large block can cause a significant price change. Additionally, not all financial contracts listed on the exchanges are heavily traded. While some contracts have greater trading volume than the underlying cash markets, others trade infre-

quently. Even with actively traded futures or options contracts, the bulk of trading generally occurs in short-dated contracts. Open interest, or the total transaction volume, in an exchange-traded contract, however, provides an indication of the liquidity of the contract in normal market conditions.

''Unbundling'' of Product Risk

Both on- and off-balance-sheet products typically contain more than one element of market-risk exposure; therefore, various hedging instruments may need to be used to hedge the inherent risk in one product. For example, a fixed coupon foreign currency–denominated security has interest-rate and foreign-exchange risks which the financial institution may choose to hedge. The hedging of the risks of this security would likely result in the use of both foreign-exchange and interest-rate contracts. Likewise, the hedging of a currency interest-rate swap, for example, would require the same.

By breaking the market risk of a particular product down into its fundamental elements, or ''unbundling'' the risks, market makers are able to move beyond product liquidity to risk liquidity. Unbundling not only eases the control of risk, it facilitates the assumption of more risk than was previously possible without causing immediate market concern or building up unacceptable levels of risk. For example, the interest-rate risk of a U.S. dollar interest-rate swap can be hedged with other swaps, forward rate agreements (FRAs), Eurodollar futures contracts, Treasury notes, or even bank loans and deposits. The customized swap may appear to be illiquid but, if its component risks are not, then other market makers would, under normal market conditions, be willing and able to provide the necessary liquidity. Positions, however, can become illiquid, particularly in a crisis.

Dynamic Hedging Risks

Certain unbundled market-risk exposures may tend to be managed as individual transactions, while other risks may be managed on a portfolio basis. The more ''perfectly hedged'' the transactions in the portfolio are, the less the need to actively manage residual risk exposures. Conversely, the use of dynamic hedging strategies to cover open price-risk exposures exposes the financial institution to increased risk when hedges cannot be easily adjusted. (Dynamic hedging is not applied to an entire portfolio, but only to the uncovered risk.) The use of dynamic hedging strategies and technical trading by a sufficient number of market participants can introduce feedback mechanisms that cause price movements to be amplified and lead to one-way markets. Some managers may estimate exposure on the basis of the assumption that dynamic hedging or other rapid portfolio adjustments will keep risk within a given range even in the face of large changes in market prices. However, such portfolio adjustments depend on the existence of sufficient market liquidity to execute the desired transactions, at reasonable costs, as underlying prices change. If a liquidity disruption were to occur, difficulty in executing the transactions needed to change the portfolio's exposure will cause the actual risk to be higher than anticipated. Those institutions who have open positions in written options and, thus, are short volatility and gamma will be the most exposed.

The complexity of the derivatives strategies of many market-making institutions can further exacerbate the problems of managing rapidly changing positions. Some financial institutions construct complex arbitrage positions, sometimes spanning several foreign markets and involving legs in markets of very different liquidity properties. For example, a dollar-based institution might hedge a deutschemark convertible bond for both equities and foreign-exchange risk and finance the bond with a dollar-deutschemark bond swap. Such a transaction may lock in many basis points in profit for the institution, but exposes it to considerable liquidity risk, especially if the arbitrage transaction involves a combination of long-term and short-term instruments (for example, if the foreign-exchange hedging were done through three-month forwards, and the bond had a maturity over one year). If key elements of the arbitrage transaction fall away, it may be extremely difficult for the institution to find suitable instruments to close the gap without sustaining a loss.

Multifaceted transactions can also be particularly difficult to unwind. The difficulty of unwinding all legs of the transaction simultaneously can temporarily create large, unhedged exposures for the financial institution. The ability to control the risk profile of many of these transactions lies in the ability to execute trades

more or less simultaneously and continuously in multiple markets, some of which may be subject to significant liquidity risks. Thus, the examiner should determine whether senior management is aware of multifaceted transactions and can monitor exposures to such linked activity, and whether adequate approaches exist to control the associated risks in a dynamic environment.

Market-Liquidity-Risk Limits

Risk measures under stress scenarios should be estimated over a number of different time horizons. While the use of a short time horizon, such as a day, may be useful for day-to-day risk management, prudent managers will also estimate risk over longer horizons because the use of such a short horizon assumes that market liquidity will always be sufficient to allow positions to be closed out at minimal losses. However, in a crisis, market liquidity, or the institution's access to markets, may be so impaired that closing out or hedging positions may be impossible, except at extremely unfavorable prices, in which case positions may be held for longer than envisioned. This unforeseen lengthening of the holding period will cause a portfolio's risk profile to be much greater than envisioned in the original risk measure, as the likelihood of a large price change (volatility) increases with the horizon length. Additionally, the risk profiles of some instruments, such as options, change radically as their remaining time to maturity decreases.

Market makers should consider the bid/ask spreads in normal markets and potential bid/ask spreads in distressed markets and establish risk limits which consider the potential illiquidity of the instruments and products. Stress tests evidencing the ''capital-at-risk'' exposures under both scenarios should be available for examiner review.

Revaluation Issues

Market makers may establish closeout valuation reserves covering open positions to take into consideration a potential lack of liquidity in the marketplace upon liquidation, or closing out of, market-risk exposures. These ''holdback'' reserves are typically booked as a contra account for the unrealized gain account. Since transactions are marked to market, holdback reserves establish some comfort that profits taken into current earnings will not dissipate over time as a result of ongoing hedging costs. Holdback reserves may represent a significant portion of the current mark-to-market exposure of a transaction or portfolio, especially for those transactions involving a large degree of dynamic hedging. The examiner should ensure, however, that the analysis provided can demonstrate a quantitative methodology for the establishment of these reserves and that these reserves, if necessary, are adequate.

Examination objectives relating to funding-liquidity risk are found in the Commercial Bank Examination Manual. *The following examination objectives relate to the examination of market-risk liquidity.*

1. To evaluate the organizational structure of the risk-management function.
2. To evaluate the adequacy of internal policies and procedures relating to the institution's capital-markets and trading activities in illiquid markets and to determine that actual operating practices reflect such policies.
3. To identify the institution's exposure and potential exposure resulting from trading in illiquid markets.
4. To determine the institution's potential exposure if liquid markets suddenly become illiquid.
5. To determine if senior management and the board of directors of the financial institution understand the potential market-liquidity-risk exposures of the trading activities of the institution.
6. To ensure that business-level management has formulated contingency plans in the event of sudden illiquid markets.
7. To ensure the comprehensiveness, accuracy, and integrity of management information systems providing analysis of market-liquidity-risk exposures.
8. To determine if the institution's liquidity-risk-management system has been correctly implemented and adequately measures the institution's exposures.
9. To determine if the open interest in exchange-traded contracts is sufficient to ensure that management would be capable of hedging or closing out open positions in one-way directional markets.
10. To determine if management is aware of limit excesses and takes appropriate action when necessary.
11. To recommend corrective action when policies, procedures, practices, or internal controls are found to be deficient.

These procedures represent a list of processes and activities that can be reviewed during a full-scope examination. The examiner-in-charge will establish the general scope of examination and work with the examination staff to tailor specific areas for review as circumstances warrant. As part of this process, the examiner reviewing a function or product will analyze and evaluate internal-audit comments and previous examination workpapers to assist in designing the scope of examination. In addition, after a general review of a particular area to be examined, the examiner should use these procedures, to the extent they are applicable, for further guidance. Ultimately, it is the seasoned judgment of the examiner and the examiner-in-charge as to which procedures are warranted in examining any particular activity.

Examination procedures relating to funding-liquidity risk are found in the Commercial Bank Examination Manual. *The following examination procedures relate to the examination of market-liquidity risk.*

1. Review the liquidity-risk-management organization.
   a. Check that the institution has a liquidity-risk-management function with a separate reporting line from traders and marketers.
   b. Determine if liquidity-risk-control personnel have sufficient credibility in the financial institution to question traders' and marketers' decisions.
   c. Determine if liquidity-risk management is involved in new-product discussions in the financial institution.
2. Identify the institution's capital-markets and trading activities and the related balance-sheet and off-balance-sheet instruments and obtain copies of all risk-management reports prepared by the institution to evaluate liquidity-risk-control personnel's demonstrated knowledge of the products traded by the financial institution and their understanding of current and potential exposures.
3. Obtain and evaluate the adequacy of risk-management policies and procedures for capital-markets and trading activities.
   a. Review market-risk policies, procedures, and limits.
   b. Review contingency market-liquidity-risk plans, if any.
   c. Review accounting and revaluation policies and procedures. Determine that revaluation procedures are appropriate.
4. Determine the credit rating and market acceptance of the financial institution as a counterparty in the markets.
5. Obtain all management information analyzing market-liquidity risk.
   a. Determine the comprehensiveness, accuracy, and integrity of analysis.
   b. Review bid/ask assumptions in a normal market scenario.
   c. Review stress tests that analyze the widening of bid/ask spreads and determine the reasonableness of assumptions.
   d. Determine whether the management information reports accurately reflect risks and that reports are provided to the appropriate level of management.
6. Determine if any recent market disruptions have affected the institution's trading activities. If so, determine the institution's market response.
7. Establish that the financial institution is following its internal policies and procedures. Determine whether the established limits adequately control the range of liquidity risks. Determine that the limits are appropriate for the institution's level of activity. Determine whether management is aware of limit excesses and takes appropriate action when necessary.
8. Determine whether the institution has established an effective audit trail that summarizes exposures and management approvals with the appropriate frequency.
9. Determine whether management considered potential illiquidity of the markets when establishing capital-at-risk exposures.
   a. Determine if the financial institution established capital-at-risk limits which address both normal and distressed market conditions.
   b. Determine if senior management and the board of directors are advised of market-liquidity-risk exposures in illiquid markets as well as of potential risk arising as a result of distressed market conditions.
10. Determine whether business managers have developed contingency plans which reflect

actions to be taken in suddenly illiquid markets to minimize losses as well as the potential damage to the institution's market-making reputation.

11. Based on information provided, determine the institution's exposure to suddenly illiquid markets resulting from dynamic hedging strategies.
12. Recommend corrective action when policies, procedures, practices, internal controls, or management information systems are found to be deficient.

The internal control questionnaire relating to funding-liquidity risk is found in the Commercial Bank Examination Manual. *The following internal control questions relate to the examination of market-risk liquidity.*

1. Review the liquidity-risk-management organization.
   a. Does the institution have a liquidity-risk-management function that has a separate reporting line from traders and marketers?
   b. Do liquidity-risk-control personnel have sufficient credibility in the financial institution to question traders' and marketers' decisions?
   c. Is liquidity-risk management involved in new-product discussions in the financial institution?
2. Identify the institution's capital-markets and trading activities and the related balance-sheet and off-balance-sheet instruments and obtain copies of all risk-management reports prepared.
   a. Do summaries identify all the institution's capital-markets products?
   b. Define the role that the institution takes for the range of capital-markets products. Determine the hedging instruments used to hedge these products. Is the institution an end-user, dealer, or market maker? If so, in what products?
   c. Do liquidity-risk-control personnel demonstrate knowledge of the products traded by the financial institution? Do they understand the current and potential exposures to the institution?
3. Does the institution have comprehensive, written risk-management policies and procedures for capital-markets and trading activities?
   a. Do the policies provide an explanation of the board of directors' and senior management's philosophy regarding illiquid markets?
   b. Have limits been approved by the board of directors?
   c. Have policies, procedures, and limits been reviewed and reapproved within the last year?
   d. Are market-liquidity-risk policies, procedures, and limits clearly defined?
   e. Are the limits appropriate for the institution and its level of capital?
   f. Are there contingency market-liquidity-risk plans?
   g. Do the policies address the use of dynamic hedging strategies?
4. Has there been a credit-rating downgrade? What has been the market response to the financial institution as a counterparty in the markets? Are instances in which the institution provides collateral to its counterparties minimal?
5. Obtain all management information analyzing market-liquidity risk.
   a. Is management information comprehensive and accurate and is the analysis sound?
   b. Are the bid/ask assumptions in a normal market scenario reasonable?
   c. Do management information reports accurately reflect risks? Are reports provided to the appropriate level of management?
6. If any recent market disruptions affected the institution's trading activities, what has been the institution's market response?
7. Is the financial institution following its internal policies and procedures? Do the established limits adequately control the range of liquidity risks? Are the limits appropriate for the institution's level of activity?
8. Has the institution established an effective audit trail that summarizes exposures and management approvals with the appropriate frequency?
9. Has management considered potential illiquidity of the markets when establishing capital-at-risk exposures?
   a. Has the financial institution established capital-at-risk limits which address both normal and distressed market conditions? Are these limits aggregated on a global basis?
   b. Are senior management and the board of directors advised of market-liquidity-risk exposures in illiquid markets as well as of potential risk arising as a result of distressed market conditions?
10. Has management determined the institution's exposure to suddenly illiquid markets resulting from dynamic hedging strategies?

Management information systems (MIS) should accumulate, interpret, and communicate information regarding the institution's positions, profits, business activities, and inherent risks. The form and content of management information for trading activities will be a function of the size and complexity of the trading operation and organization, policies and procedures, and management reporting lines. MIS generally take two forms: computing systems with business applications and management reporting. For institutions with trading operations, a computerized system should be in place. For a small number of institutions with limited trading activity, an elaborate computerized system may not be cost effective. Not all management information systems are fully integrated. Examiners should expect to see varying degrees of manual intervention and should determine whether the integrity of the data is preserved through proper controls. The examiner should review and evaluate the sophistication and capability of the financial institution's computer systems and software, which should be capable of supporting, processing, and monitoring the capital-markets and trading activities of the financial institution.

An accurate, informative, and timely management information system is essential to the prudent operation of a trading or derivative activity. Accordingly, the examiner's assessment of the quality of the management information system is an important factor in the overall evaluation of the risk-management process. Examiners should determine the extent to which the risk-management function monitors and reports its measure of trading risks to appropriate levels of senior management and the board of directors. Exposures and profit-and-loss statements should be reported at least daily to managers who supervise but do not conduct trading activities. More frequent reports should be made as market conditions dictate. Reports to other levels of senior management and the board may occur less frequently, but examiners should determine whether the frequency of reporting provides these individuals with adequate information to judge the changing nature of the institution's risk profile.

Examiners should ensure that the management information systems translate the measured risk from a technical and quantitative format to one that can be easily read and understood by senior managers and directors, who may not have specialized and technical knowledge of trading activities and derivative products. Risk exposures arising from various products within the trading function should be reported to senior managers and directors using a common conceptual framework for measuring and limiting risks.

PROFESSIONAL EXPERTISE

The trading institution should have personnel with sufficient expertise to understand the financial instruments and maintain the management information system. Reports should be updated to reflect the changes in the business environment. Institutions that develop their own applications should have adequate staff to alter and test current software. Also, the implementation of automated reporting systems is not a substitute for an adequate reconcilement procedure that would ensure the integrity of data inputs. The system must be independently audited by personnel with sufficient expertise to perform a comprehensive review of management reporting, financial applications, and systems capacity.

COMPUTING SYSTEMS

Worldwide deregulation of financial markets combined with the latest tools in information technologies have brought capital markets together so that geographic financial centers are no longer as important. Access to markets on competitive terms from any location is made possible by instantaneous worldwide transmission of news and market information. To manage their risk-management process in the current financial and technological environment, financial institutions are more readily prepared to incorporate the latest communications systems and database management techniques. In addition, new financial concepts are rapidly becoming standard practice in the industry, made possible by powerful computing tools and communications systems.

Some capital-markets instruments require information technologies that are more complex than those used for more traditional banking products, such as loans, deposits, and standard

foreign-exchange transactions. Indeed, a department developing specialized trading products and their supporting systems is often viewed by senior management as the laboratory for the financial institution. For financial institutions active in capital markets, conducting business in a safe and sound manner depends on the successful integration of management information systems into the daily processes of market- and credit-risk management; transaction processing; settlement; accounting; and financial, regulatory, and management reporting.

Examiners should evaluate the processes of software development, technical specifications, database management, local area networks, and communication systems. Access to the automated systems should be adequately protected. If the organization uses PCs, a written policy to address access, development, maintenance, and other relevant issues should exist. Given the specialized management skills and heightened sophistication in information technologies found in many trading rooms, an evaluation of systems management should be incorporated into the overall assessment of management and internal controls. A full-scope examination of these areas is best performed by specialized electronic data processing examiners. However, a general review of these processes must also be incorporated in the financial examination.

For examination purposes, the scope of the review should be tailored to the functionality of the management information system as opposed to its technical specifications. Functionality refers to how well the system serves the needs of users in all areas of the institution, including senior management, risk management, front office, back office, financial reporting, and internal audit. The organization should have flow charts or narratives that indicate the data flow from input through reporting. The comprehensiveness of this information, however, will depend on the level of reporting necessary for the institution.

An important aspect of evaluating information technology is the degree to which various systems interface. For purposes of this discussion, automated systems refers to the collection of various front-office and control systems. Financial institutions relying on a single database of client and transaction files may have stronger controls on data integrity than those with multiple sources of data. However, rarely does a single automated system handle data entry and all processing and control functions relevant to all over-the-counter and exchange-traded instruments used by an institution. The group of systems used may be a combination of systems purchased from vendors and applications developed in-house by the firm's software programmers. Standard instructions should be set within the automated systems. The organization should identify which instructions may be overridden and under what circumstances.

The organization should give planned enhancement or development projects appropriate priority, given management's stated goals and capital-markets activity. Third-party vendors should be provided with adequate lead time to make changes to existing programs. Sufficient testing should be performed before system upgrades are implemented.

When consolidating data derived from multiple sources, the institution should perform controls and reconciliations that minimize the potential for corrupting consolidated data. If independent databases are used to support subsidiary systems, then reconciliation controls should be evident at each point that multiple data files are brought together. Regardless of the combination of automated systems and manual processes, examiners should ensure that appropriate validation processes are effected to ensure data integrity.

Not all financial institutions have the same automation requirements. For institutions with limited transaction volume, it is not cost effective to perform risk-management reporting in an automated environment, and most analysis can be handled manually. When volumes increase such that timely risk monitoring can no longer be handled manually, then automated applications may be appropriate.

MODEL RISK

A key element of the management information system of trading operations is models and algorithms used to measure and manage risk. The frequency and extent to which financial institutions should reevaluate their models and assumptions depend, in part, on the specific risk exposures created by their trading activities, the pace and nature of market changes, and the pace of innovation with respect to measuring and managing risks. At a minimum, financial institutions with significant capital-markets and trading activities should review the underlying methodologies and assumptions of their models

at least annually, and more often as market conditions dictate, to ensure that they are appropriate and consistent for all products. Such internal evaluations may, in many cases, be supplemented with reviews by external auditors or other qualified outside parties, such as consultants who have expertise with highly technical models and risk-management techniques.

When introducing a pricing model, it is imperative that adequate testing of the algorithm be performed by systems personnel with appropriate sign-off by model users (traders, controllers, and auditors). In practice, pricing models for the most heavily traded financial instruments are well tested. Financial algorithms for complex, exotic products should be well documented as part of the policies and procedures manual and functional specifications. Hazards are more likely to arise for instruments that have nonstandard or option-like features. The use of proprietary models that employ unconventional techniques that are not widely agreed upon by market participants should lead to further questioning by examiners. Even the use of standard models may lead to errors if the financial tools are not appropriate for a given instrument.

NEW PRODUCTS

The development of new products is a key feature of capital-markets and trading operations. The general risks associated with new products should be addressed through the new-product-approval process. In reviewing financial applications, examiners should evaluate whether the current tools quantify and monitor the range of relevant exposures. New applications require special review and additional measures of control. In the absence of a model that provides a reasonable simulation of market price, the risk-management, control, and audit areas should be responsible for developing an appropriate valuation methodology. Nonstandard software applications should proceed through the institution's software development process for testing before implementation. They should not be released for actual business use until validation and sign-off is obtained from appropriate functional departments.

Parameter Selection and Review

Examiners should ensure that financial institutions have a process whereby parameters used in valuation models depend on rigorous statistical methods and are updated to reflect changing market conditions. To the extent possible, the results derived from statistical methods should be validated against available market information.

Models that incorporate assumptions about underlying market conditions or price relationships require ongoing monitoring. Input parameters such as volatility, correlations between market prices, interest rates and currencies, and prepayment speeds of underlying mortgage pools require frequent review. For example, volatility quotes may be compared to those in available published sources, or from implied volatilities derived from a pricing model using current market prices of actively traded exchange-listed options. Mortgage securities prepayment assumptions can be compared to vectors provided by the dealer community to automated services or to factors provided by third-party vendors.

Examiners should evaluate the ability of an institution's model to accommodate changes in assumptions and parameters. Institutions should conduct ''what-if'' analyses and tests of the sensitivity of specific portfolios or their aggregate risk position. Examiners should expect the risk-management and measurement system to be sufficiently flexible to stress test the range of portfolios managed by the institution. Any parameter variations used for stress tests or what-if analyses should be clearly identified. These simulations usually summarize the profit or loss given a change in interest rates, foreign-exchange rates, equity or commodity prices, volatility, or time to maturity or expiry.

MANAGEMENT INFORMATION REPORTING

Management reporting summarizes day-to-day operations, including risk exposure. The financial institution's goal and market profile will be reflected in the reporting format and process at the operational level. These reporting formats should be evaluated for data integrity and clarity. Examiners should determine if reporting is sufficiently comprehensive for sound decision making.

In addition, reports are used to provide management with an overall view of business activity for strategic planning. Overall management

reporting should reflect the organizational structure of the institution and the risk tolerance of senior management. Examiners should expect reports to aggregate data across geographic locations when appropriate and segregate positions by legal entity when appropriate. Examiners may find that periodic reporting is provided to management on market-limit and credit-line utilization. Management uses these to reevaluate the limit structure, relate risks to profitability over a discrete period, evaluate growing businesses, and identify areas of potential profit. Management reporting also should relate risks undertaken to return on capital. In fact, management information systems should allow management to identify and address market, credit, and liquidity risks. See sections 2010.1, 2020.1, and 2030.1 on market, credit, and liquidity risk, respectively.

Management reports will usually be generated by control departments within the institution, independent from front-office influence. When front-office managers have input to reports, the senior managers should be well aware of potential weaknesses in the data provided. Risk reporting should be assessed and performed independently of the front office to ensure objectivity and accuracy and to prevent manipulation or fraud. However, if the back office uses databases and software programs that are independent from those used in the front office, it needs to perform a periodic reconciliation of differences. For financial institutions operating in a less automated environment, report preparation should be evaluated in terms of timeliness and data accuracy. Cross-checking and sign-off by the report preparer and reviewer with appropriate authority should be evident.

Each financial institution will define the acceptable tradeoff between model accuracy and information timeliness. As part of their appraisal of risk management, examiners should review the frequency and accuracy of reporting against the institution's posture in the marketplace, volume of activity, aggregate range of exposures, and capacity to absorb losses.

1. To determine the scope and adequacy of the audit function for management information systems and management reporting.
2. To determine if the policies, practices, procedures, and internal controls regarding management information systems and management reporting are adequate.
3. To ensure that only authorized users are able to gain access to automated systems.
4. To evaluate computer systems, communications networks, and software applications in terms of their ability to support and control the capital-markets and trading activities.
5. To determine that the functions of automated systems and reporting processes are well understood by staff and are fully documented.
6. To determine that software applications pertaining to risk reporting, pricing, and other applications that depend on modeling are fully documented and subject to independent review.
7. To determine that the automated systems and manual processes are designed with sufficient audit trails to evaluate and ensure data integrity.
8. To ensure that reports are fully described in functional specifications and are also included in the policies and procedures of the respective user departments.
9. To determine whether management reporting provides adequate information for strategic planning.
10. To determine that risk-management reporting summarizes the quantifiable and nonquantifiable risks facing the institution.
11. To determine whether financial performance reports are accurate and sufficiently detailed to relate profits to risks assumed.
12. To evaluate summary reports on operations for adequacy.
13. To recommend corrective action when policies, practices, procedures, internal controls, or management information systems are deficient.

These procedures represent a list of processes and activities that may be reviewed during a full-scope examination. The examiner-in-charge will establish the general scope of examination and work with the examination staff to tailor specific areas for review as circumstances warrant. As part of this process, the examiner reviewing a function or product will analyze and evaluate internal-audit comments and previous examination workpapers to assist in designing the scope of examination. In addition, after a general review of a particular area to be examined, the examiner should use these procedures, to the extent they are applicable, for further guidance. Ultimately, it is the seasoned judgment of the examiner and the examiner-in-charge as to which procedures are warranted in examining any particular activity.

1. Obtain copies of internal and external audit reports for MIS and management reporting. Review findings and management's responses to them and determine whether appropriate corrective action was taken.
2. Obtain a flow chart of reporting and systems flows and review information to identify important risk points. Review policies and procedures for MIS. Review the personal computer policy for the institution, if available.
3. Determine the usage of financial applications on terminals that are not part of the mainframe, minicomputer, or local area network. For instance, traders may use their own written spreadsheet to monitor risk exposure or for reconciliation.
4. Obtain an overview of the system's functional features. Browse the system with the institution's systems administrator. Determine whether passwords are used and access to the automated system is restricted to approved users.
5. Review a list of ongoing or planned management information systems projects. Determine whether the priority of projects is justified given management's strategic goals and recent mix of business activity.
6. From the systems overview, ascertain the range of databases in use. Some system architecture may use independent databases for front office, back office, or credit administration. Determine the types of reconciliations performed, frequency of database reconciliation, and tolerance for variance. The more independent databases are, the more the potential for data error exists.
7. Determine the extent of data-parameter defaults, for example, standard settlement instructions to alleviate manual intervention. Determine the extent of manual intervention for transaction processing, financial analysis, and management reporting.
8. Review the policies and procedures manual for reporting requirements for management.
9. Determine whether the automated and manual process have sufficient audit trails to evaluate and ensure data integrity for the range of functional applications. Determine how control staff validates report content and whether the report content is well understood by the preparer.
10. Determine whether the processing and production of reports is segregated from front-office staff. When the front office has influence, how does management validate summary data and findings?
11. Review the functional applications such as credit administration, trade settlement, accounting, revaluation, and risk monitoring to determine the combination of automation and manual intervention for management reporting. Compare findings with examiners reviewing specific products or business lines.
12. Determine whether the documentation supporting pricing models is adequate. Determine whether ''user instructions'' provide sufficient guidance in model use.
13. Determine whether the range of risk-management reports is adequately documented in terms of inputs (databases, data-feeds external to the organization, economic and market assumptions), computational features, and outputs (report formats, definitions). Evaluate the documentation for thoroughness and comprehensiveness.
14. Determine whether the range of reports (risk management, financial performance and operational controls) provides valid results to evaluate business activity and for strategic planning.

15. Recommend corrective action when policies, practices, procedures, internal controls, or management information systems are deficient.

1. Is the scope of the audit coverage comprehensive? Are audits for management information systems and reporting available? Are findings discussed with management? Has management implemented timely corrective actions for deficiencies?
2. Do policies and procedures address the range of system development and technical maintenance at the institution, including the use of outside vendors and consultants? Does the institution have a comprehensive personal computer policy? If the organization uses PCs, is there a written policy to address access, development, maintenance, and other relevant issues?
3. Do the new product policies and procedures require notification and sign-off by key systems development and management reporting staff?
4. Are there functional specifications for the systems? Are they adequate for the current range of automated systems at the institution? Do they address both automated and manual input and intervention?
5. Does the organization have flow charts or narratives that indicate the data flow from input through reporting? Is this information comprehensive for the level of reporting necessary for the financial institution?
6. Is access to the automated systems adequately protected?
   a. Do access rights, passwords, and logon ID's protect key databases from corruption?
   b. Are ''write or edit'' commands restricted to a limited set of individuals?
   c. Are specific functions assigned to a limited set of individuals? Are access rights reviewed periodically?
   d. Does the system have an audit report for monitoring user access?
   e. Is access logon information stored in records for audit trail support?
7. Is management information provided from mainframe, minicomputers, local area networks (multiuser personal computer networks), or single-user personal computers or a combination of the above?
8. Are third-party vendors provided with adequate lead time to make changes to existing programs? Is sufficient testing performed before system upgrades are implemented?
9. Do planned enhancement or development projects have appropriate priority, given management's stated goals and capital-markets activity?
10. Identify the key databases used for the range of management reports.
    a. Are direct electronic feeds from external services such as Reuters, Telerate, and Bloomberg employed? How are incomplete datafeeds identified? Can market data be overridden by users? How does the institution ensure the data integrity of datafeeds or manually input rates, yields, or prices from market sources?
    b. Are standard instructions set within the automated systems? Can these be overridden? Under what circumstances?
    c. For merging and combining databases, how does the institution ensure accurate output?
    d. What periodic reconciliations are performed to ensure data integrity? Is the reconciliation clerk sufficiently familiar with the information to identify ''contaminated'' data?
11. Does the institution have a model-validation process? Does the organization use consultants for model development and validation? Are these consultants used effectively? Are the yield curve calculations, interpolation methods, discount factors, and other parameters used clearly documented and appropriate to the instruments utilized? Regardless of the source of the model, how does management ensure accurate and consistent results?
12. Does the system design account for the different pricing conventions and accrual methods across the range of products in use at the financial institution? Evaluate the range of system limitations for processing and valuation across the range of products used by the institution. Assess the possible impact on accuracy of management reporting.
13. Is management reporting prepared on a sufficiently independent basis from line management? Is management reporting adequate for the volume and complexity of

capital-markets and trading activities for the types of reports listed below? Are reports complete? Do they have clear formats? Are the data accurate? Are exceptions highlighted? Is appropriate segregation of duties in place for report preparation? Are there reports for the following:

a. Market-risk exposure against limits?
b. Credit-risk exposure against limits?
c. Market-liquidity risk exposure against limits?
d. Funding-liquidity risk exposure against market demand?
e. Transaction volumes and business mix?
f. Profit and loss?
g. Other risk exposures and management information reports?

14. Do reports reflect aggregation of data across geographic locations when appropriate?
15. Do reports segregate positions by legal entity when appropriate?
16. Determine whether the system for measuring and managing risk is sufficiently flexible to stress test the range of portfolios managed by the institution. Does the system provide usable and accurate output? If the institution does not perform automated stress testing, what process is used to minimize quantifiable risks in adverse markets?
17. Are parameter variations used for stress tests or are "what if" analyses clearly identified?
18. Does management reporting relate risks undertaken to return on capital?
19. Do reports provide information on the business units that is adequate for sound strategic planning? Are profitable and unprofitable businesses clearly identified? Does management have adequate information?